Operation and Maintenance Report
January 2017 to December 2017

McCormick and Baxter Superfund Site

Portland, Oregon
ECSI Site No. 74

Prepared for
Oregon Department of Environmental Quality

March 29, 2018
15670-10/Task 4

HARTCROWSER

GSI Water Solutions, Inc.

www.hartcrowser.com

HARTCROWSER

Operational and Maintenance Report
January 2017 to December 2017

McCormick and Baxter Superfund Site

Portland, Oregon

Prepared for
Oregon Department of Environmental Quality

March 29, 2018
15670-10/Task 4

Prepared by

GSI Water Solutions, Inc.

Erin Carroll Hughes, LHG
Hydrogeologist

Hart Crowser, Inc.

Richard D. Ernst, RG
Program Manager

Hart Crowser, Inc.

Philip R. Cordell, RG
Site Manager

6420 SW Macadam Ave., Suite 100
Portland, Oregon 97239
Fax 503.620.6918
Tel 503.620.7284

Contents

TABLES

FIGURES

FIGURES (CONTINUED)

APPENDIX A

APPENDIX B

APPENDIX C

Acronyms and Abbreviations

ACB	articulated concrete block
ACLs	alternate concentration limits
AWQC	ambient water quality criteria
bgs	below ground surface
BES	City of Portland, Bureau of Environmental Services
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquid
EPA	U.S. Environmental Protection Agency
ft/ft	foot per foot
FWDA	Former Waste Disposal Area
HC/GSI	Hart Crowser, Inc./GSI Water Solutions, Inc.
ICs	institutional controls
IGA	Intergovernmental Agreement
LNAPL	light non-aqueous phase liquid
MCLs	maximum contaminant levels
mg/kg	milligrams per kilogram
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
ng/L	nanograms per liter
O&M	Operation and Maintenance
PAHs	polycyclic aromatic hydrocarbons
PCP	pentachlorophenol
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RM	River Mile
ROD	Record of Decision
site	McCormick and Baxter Superfund site
TFA	Tank Farm Area
TRM	turf-reinforced matting
µg/L	micrograms per liter
USGS	U.S. Geological Survey

Operation and Maintenance Report
January 2017 to December 2017

McCormick and Baxter Superfund Site

Portland, Oregon

1.0 INTRODUCTION AND PURPOSE

This Operation and Maintenance (O&M) Report has been prepared for the Oregon Department of Environmental Quality (DEQ) to document the O&M activities implemented at the McCormick and Baxter Superfund Site (site) located in Portland, Multnomah County, Oregon, between January 1, 2017, and December 31, 2017.

O&M activities are identified in the Final O&M Plan prepared by the DEQ and the U.S. Environmental Protection Agency (EPA) (DEQ/EPA 2014). The Final O&M Plan defines the administrative, financial, and technical details and requirements for inspecting, operating, and maintaining the remedial actions at the site. The DEQ and EPA reduced the scope and frequency of O&M activities conducted at the site in 2010, from the frequency conducted at the site from 2005 through 2010. The Final O&M Plan reflects that reduction. The O&M Manual specifies the sampling and monitoring procedures, quality assurance and quality control, technical information, and data necessary for implementing O&M activities. The O&M Manual is a living document that is modified periodically to reflect necessary monitoring and maintenance needs at the site. Hart Crowser, Inc., and GSI Water Solutions, Inc. (HC/GSI) recently updated the O&M Manual in June 2016 (HC/GSI 2016).

The purpose of this O&M Report is to document the operation, monitoring, and maintenance activities that occurred in calendar year 2017. Figure 1-1 shows the location of the site, Figure 1-2 presents the site layout and features, and Figure 1-3 presents the site capping components. Figure 1-4 presents the site layout with surface elevations. Figure 1-5 presents the historical contaminant areas, and Figure 1-6 presents historical non-aqueous phase liquid (NAPL) distribution. This report has been prepared by DEQ's contractor team, Hart Crowser and GSI.

The O&M performance standards and activities for the soil cap and sediment cap are discussed in Sections 2 and 3, respectively. The groundwater performance standards and activities are summarized in Section 4. Vegetation management is presented in Section 5. Section 6 discusses the remedy protectiveness, and Section 7 presents recommendations for 2018. Section 8 provides references. Appendix A provides a photograph log of activities or observations associated with O&M activities. Appendix B provides documentation including the field observation forms for the soil and sediment cap, status meeting summaries, and the sign-in log. Appendix C provides the photograph log for vegetation observations.

Routine operation, monitoring, and maintenance activities in 2017 were implemented primarily by the DEQ's contractor, Hart Crowser, and its teaming partner GSI (under subcontract to Hart Crowser).

O&M activities were also performed by Amaral (weed control) and Oregon Demolition (trailer removal).

Key personnel for implementation of O&M activities include:

- Sarah Miller: Oregon DEQ Project Officer
- Steve Campbell: Oregon DEQ Contract Officer
- Rick Ernst: Hart Crowser Program Manager
- Heidi Blischke: GSI Technical Manager
- Phil Cordell: Hart Crowser Site Manager
- Erin Carroll Hughes: GSI Hydrogeologist

2.0 SOIL CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section presents a summary of soil cap performance standards, observations, and maintenance activities at the site for the reporting period January 1, 2017, through December 31, 2017, and a summary of remedy performance as related to the performance standards. The Final O&M Plan provides a description of the remedial action objectives and the soil operable unit remedy. Table 2-1 provides the soil cap activities conducted in 2017.

2.1 Soil Cap Performance Standards

Contaminated soil was removed and an upland soil cap was constructed on approximately 41 acres of the site in September 2005. Institutional controls (ICs) have not been completed for this portion of the site. Soil beneath the soil cap remains contaminated with arsenic, pentachlorophenol (PCP), polycyclic aromatic hydrocarbons (PAHs), dioxins, and NAPL and requires long-term monitoring and maintenance. The performance standards for the soil cap are as follows.

- Maintain contaminant concentrations in surface soil below the following risk-based cleanup goals, as specified in the Record of Decision (ROD) (EPA 1996):
    - Arsenic: 8 milligrams per kilogram (mg/kg)
    - PCP: 50 mg/kg
    - Total carcinogenic PAHs: 1 mg/kg
    - Dioxins/furans: 0.00004 mg/kg
- Maintain the topsoil layer to within 50 percent of its design specification as follows:
    - Maintain a topsoil thickness of at least 6 inches for the area over the impermeable geomembrane cap.

- Maintain a topsoil thickness of at least 12 inches for all areas except over the impermeable geomembrane cap.

- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining the subsurface stormwater conveyance system.

- Minimize stormwater erosion and ponding outside the barrier wall by maintaining site grading, surface stormwater conveyance, and native vegetation.

- Maintain native vegetation within the 6-acre riparian zone for compliance with the National Marine Fisheries Service Biological Opinion (National Oceanic and Atmospheric Administration [NOAA] 2004).

2.2 Soil Cap Observations

Soil cap observations were conducted according to the Final O&M Plan. Routine site inspections were conducted on January 27, April 21, July 23, and October 23, 2017, by the DEQ, Hart Crowser, and GSI. These inspections are documented on observation forms developed for the site. Supporting documentation and pertinent details are included in Appendix B. Observations of interest from the routine inspections are summarized on Figure 2-1 and described below. Representative site photographs taken in 2017 are presented in Appendix A. As required for the site administrative record, a log of all site visitors in 2017 was kept and is also included in Appendix B.

2.2.1 Visual Inspection

The upland soil cap provides habitat for rabbits, ground squirrels, Canada geese, several other species of birds, and coyotes. Despite placing gravel to fill gaps under the fence around the upland portion of the site, periodic burrowing continues to be observed under the fence and along the perimeter road. These burrows are filled as necessary and are not of major concern.

Evidence of ground squirrel activity was observed at several locations throughout the upland soil cap. Ground squirrels are common to the area, and their burrows typically extend to approximately 1 foot below ground surface (bgs). The ground squirrels use the surplus articulated concrete block (ACB) stockpiled at the site, paved roadway, and concrete well monuments as habitat. A typical animal burrow was observed on the soil cap, likely from a small rodent (Photograph 1, Appendix A). None of the observed burrows extend more than 1 foot into the 2-foot soil cap and, therefore, the soil cap continues to isolate site contaminants from human and ecological receptors. Continued monitoring of the burrows is recommended; no action to remove burrowing animals or to fill in the burrows is planned or is necessary at this time.

The gate at the top of North Edgewater Road marks the entrance to the site and Willamette Cove property. This gate, which is locked with a series of locks and a chain, provides access for two railroads, Northwest Natural, the DEQ, and other agencies that require access to the area. The Union Pacific Railroad tracks, which run parallel to the site and neighboring properties, are often used by transients and the public to access the area. Access to the area generally does not affect security because of the surrounding fence and lighting at the site.

2.2.2 Soil Cap Subsidence

In June 2008, subsidence of the soil cap was observed near groundwater monitoring wells EW-1s and MW-23d. An upland site survey confirmed that the ground surface had subsided approximately 1 foot in a limited area around the wells between the time that the soil cap was installed in 2005 and 2008. A Subsidence in Upland Cap Memorandum (HC/GSI 2008) and an Additional Subsidence Monitoring Memorandum (HC/GSI 2009) present the results of the survey and additional investigation to determine the cause of the subsidence.

Based on elevated groundwater temperatures in well EW-1s (40 °C) and the large amount of buried woody debris in the area, it was suspected that aerobic degradation of woody debris was occurring and causing the ground surface subsidence. Decreasing groundwater levels within the barrier wall also may have contributed by opening a larger unsaturated zone that allows compaction. In 2009, the shallow well EW-1s was sealed to reduce the amount of oxygen reaching the unsaturated zone. After the well was sealed, subsidence slowed with no additional subsidence being observed over the past 5 years. The groundwater temperature dropped to approximately 21-23°C and has remained stable for the past 5 years. This temperature is still higher than groundwater from surrounding wells (approximately 13°C) indicating that some heat is still being produced in the subsurface near well EW-1s; this may be caused by anaerobic degradation, which generates less heat than aerobic degradation.

Ground surface subsidence is monitored by measuring the inner polyvinyl chloride (PVC) casing at well MW-23d relative to the steel outer casing of the well. The inner casing extends to 182 feet bgs and is considered to be stable. The outer casing is representative of the ground surface and if the casing (or ground surface) subsides, then the distance between the inner and outer casing decreases. Since 2012, the distance has been measured at approximately 2.75 inches. Slight differences in the distance measured (within 0.10 inch for all events) are likely due to variability in measuring equipment and operators. Previously, the total decrease in distance between the inner and outer casing from December 2008 (first periodic measurement conducted) to 2012 was approximately 1.35 inches, with most of the decrease occurring in 2009. Thus, approximately 1.35 inches of subsidence of the ground surface in this area has occurred since 2008.

While not anticipated, significant additional settling in this area could affect performance of the stormwater conveyance system. The stormwater conveyance system is inspected quarterly and continues to perform as designed with steady flow from the outfall during and immediately after rainfall events. During 2017, Hart Crowser and GSI continued to monitor the area by measuring the casing difference at MW-23d, continuously measuring the water level and temperature at EW-1s, and monitoring the discharge at the stormwater conveyance system outfall.

2.3 Soil Cap Maintenance Activities

Relatively little soil cap maintenance was required in 2017. Maintenance in 2017 included overgrown vegetation pruning and filling animal burrows along the fence line. Weed control was conducted in the spring of 2017 and is discussed in detail in Section 5.4.

Following the July 20, 2017, site inspection, burrows were filled around the perimeter fence. Additional site infrastructure activities were conducted. The power to the trailers was disconnected and the alarm system removed on January 26, 2017. Oregon Demolition removed and took title to the two job trailers, which were deteriorating and obsolete, on February 9, 2017 (Photograph 2; Appendix A). The backflow preventer on the waterline was tested on September 15, 2017.

2.4 Summary of Soil Cap Remedy Performance

Overall, upland soil cap observations and inspections revealed no significant change in remedy performance or areas of concern. Future O&M activities will primarily consist of quarterly inspections and routine maintenance. Decommissioning of nonessential and obsolete equipment began with removal of the irrigation system in December 2015 and continued with removal of the job trailers in February 2017.

The degree of upland soil cap subsidence near wells EW-1s and MW-23d is currently stable. This area will continue to be monitored in 2018 by taking inner and outer casing measurements at well MW-23d; by monitoring stormwater flow at the outfall during quarterly inspections; and by collecting and reviewing transducer data from EW-1s that measures groundwater temperature and elevation.

3.0 SEDIMENT CAP PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes sediment cap observation and maintenance activities for the reporting period January 1, 2017, through December 31, 2017. Site observations and maintenance activities were conducted according to the Final O&M Plan. Sediment cap inspections were conducted in January, April, July, and October 2017 by the DEQ, Hart Crowser, and GSI in conjunction with inspections for the entire site. Observations of interest from the routine inspections and site meetings are presented on Figure 2-1. Routine inspections are documented in observation forms developed and recorded for the site (Appendix B). Table 3-1 provides a summary of sediment cap activities conducted in 2017.

3.1 Sediment Cap Performance Standards

The sediment remedy consists of a 23-acre cap over contaminated sediment within the Willamette River and includes ICs. The sediment cap remedy was completed in September 2005, and an Easement and Equitable Servitude was completed in 2006 to restrict sediment cap use and access. Sediment beneath the sediment cap remains contaminated with arsenic, PCP, PAHs, dioxins, and NAPL. The performance standards for the sediment cap are as follows.

- Maintain contaminant concentrations in surface sediment below the following risk-based cleanup goals, as specified in the ROD (EPA 1996).
  - Arsenic: 12 mg/kg, dry weight
  - PCP: 100 mg/kg, dry weight
  - Total carcinogenic PAHs: 2 mg/kg, dry weight

- Dioxins/furans: 8×10^{-5} mg/kg, dry weight
- Protection of benthic organisms based on sediment bioassay tests, resulting in impaired survival and growth (i.e., weight)

■ Minimize contaminant releases from sediment that might result in contamination of the Willamette River in excess of the following federal and state ambient water quality criteria (AWQC):

- Arsenic (III): 190 micrograms per liter (µg/L)
- Chromium (III): 210 µg/L
- Copper: 12 µg/L
- Zinc: 110 µg/L
- PCP: 13 µg/L
- Acenaphthene: 520 µg/L
- Fluoranthene: 54 µg/L
- Naphthalene: 620 µg/L
- Total carcinogenic PAHs: 0.031 µg/L
- Dioxins/furans: 1.4×10^{-5} nanograms per liter (ng/L)

■ Maintain the armoring layer to within 50 percent of the design specification throughout the cap. The design specifications are as follows:

- 6-inch rock armoring: maintain at least 6 inches thick
- 12-inch rock armoring: maintain at least 7.5 inches thick
- 24-inch rock armoring: maintain at least 12 inches thick

■ Maintain uniformity and continuity of ACB armoring.

■ Assess performance of organophilic clay to ensure it is preventing the release of mobile NAPL to the Willamette River (potential assessment parameters include sorption capacity, measure of NAPL currently sorbed, and permeability).

AWQCs listed above were the surface water criteria in effect at the time of the ROD (EPA 1996). Since completion of the ROD, additional recommended EPA water quality criteria were published in 2007, and more stringent AWQCs for human health were adopted by the DEQ and approved by the EPA in 2011. During meetings in August 2007 among stakeholders (DEQ, EPA, National Oceanic and Atmospheric Administration, Confederated Tribes of Warm Springs, and Yakama Nation), it was agreed that for comparison purposes, the following five criteria would be included in analytical results summary tables in the Annual O&M Reports.

- Two AWQCs in effect at the time the ROD was issued:
  - 1996 criteria for chronic effects to aquatic life
  - 1996 criteria for human health based on fish consumption
- Two 2007 National Recommended Water Quality Criteria:
  - 2007 criteria for chronic effects to aquatic life
  - 2007 criteria for human health (consumption of organisms)
- Current EPA maximum contaminant levels (MCLs)

Future comparison criteria will include the EPA-approved 2011 AWQCs updated in 2015 for human health and other applicable AWQCs at the time of sediment cap water sampling. These criteria were used as comparison criteria for the Fall 2015 passive surface water and sediment cap porewater sampling event.

3.2 Sediment Cap Observations

Routine sediment cap inspections were conducted on January 27, April 21, July 23, and October 23, 2017, in conjunction with the four quarterly site meetings. Sediment cap inspection documentation is included in Appendix B. Sections 3.2.1 and 3.2.2 describe sediment cap observations regarding habitat enhancement features, wildlife, vandalism, and/or trespassing. In general, the sediment cap remains in good condition. Shoreline sheen was not observed in 2017. Limited ebullition was observed primarily within the two areas of the sediment cap where granular organophilic clay is present. Representative site photographs taken in 2017 are presented in Appendix A.

3.2.1 Habitat Enhancement Features and Wildlife

Habitat enhancement features such as boulder clusters and sand cover as a biotic layer are design elements of the sediment cap. Large woody debris also provides habitat enhancement along the shoreline and in the Riparian Area above the shoreline. The distribution of sand cover over the ACB is similar to previous years. Originally, sand was placed over a large portion of the shoreline and Willamette Cove ACB armoring, but high river flow conditions and wake from passing boats have washed sand from the ACB where the bank slopes are steeper. Rounded gravel (1-1/2-inch-minus) was placed within the ACB voids along a large portion of the shoreline and Willamette Cove in October 2012. The gravel has largely remained in place through 2017; however, some has washed down steeper shorelines and has settled onto lower ACB surfaces. Shoreline conditions and the distribution of the ACB gravel are shown in the Photograph Log (Photograph 3, Appendix A).

Large pieces of driftwood are deposited along the shoreline at higher elevations during high river-stage events. The amount of driftwood moving through the site appears to remain fairly consistent every year. Erosion of soil mulch and vegetation cover on the green turf-reinforced matting (TRM), near the lower riparian/ACB armoring, occurs periodically during high river levels. TRM repairs, including filling voids with crushed rock and re-securing to the ACB with concrete anchor nails, occurred in 2012 and 2015. Minor TRM damage was observed in several areas following high spring river levels. The Willamette River did not reach flood stage in 2016 (23 feet NAVD88), but the highest river level recorded since the cap was installed occurred on March 30, 2017, when the river reached an elevation of approximately 22.28 feet NAVD88. The prior repairs to the TRM were not affected and continue to function as expected. The ACB, however, sustained minor damage from the high river levels. In September 2016, Hart Crowser completed repairs to the ACB, as detailed in Section 3.3.

Three areas of the shoreline appear to accumulate more woody debris than other areas:

- The south end of the shoreline near the City of Portland outfall;
- Along the shoreline near the former Tank Farm Area (TFA); and
- The north end of the site near the Burlington Northern Railroad bridge.

Boulder clusters placed during the sediment cap construction remained in place during 2017.

Numerous wildlife species continue to be observed site-wide; birds seen most frequently include Canada geese, gulls, cormorants, pigeons, blue herons, ospreys, and hawks.

3.2.2 Vandalism and Trespassing

The shoreline along the site and in the Willamette Cove is accessible and is used by the public for various forms of recreation. Throughout 2017, shoreline trash and graffiti were observed, including scattered car parts above the Riparian Area. Numerous dilapidated boats (used as dwellings) were also seen anchored in the Willamette Cove during every site visit (Photograph 4, Appendix A). Boats were not observed to be anchored on the sediment cap during site inspections. No effects to the sediment cap were observed from mooring or from physical contact with these boats on the sediment cap. The US Coast Guard and Oregon State Marine Board rules prohibit anchoring on the sediment cap.

3.2.3 Buoys

Five permanent buoys were installed in August 2011, along the perimeter of the sediment cap warning boaters of navigational hazards. Buoys were observed to be in place throughout 2017.

3.3 Sediment Cap Maintenance Activities

The sediment cap was designed to be generally maintenance free. ACB repairs were completed in September 2017 that consisted of placing concrete in 11 areas where 2- to 4-inch voids developed between ACB mats (Photograph 9, Appendix A). The repairs were completed by placing concrete in the voids to reduce the trip hazard and protect the cap. Repairs were completed when river levels were low, allowing the concrete ample time to cure and eliminating the chance for runoff to the river. Additionally, riparian vegetation at the upper portions of the sediment cap required watering in August 2017 (see Section 5.3 for further discussion).

3.4 Summary of Sediment Cap Remedy Performance

Overall, the sediment cap observations and inspections revealed no significant change in remedy performance or areas of concern. Future O&M activities primarily will consist of quarterly inspections and routine maintenance. Sediment cap porewater and surface water sampling was conducted in 2015 with results reported in the 2015 Annual Report and the Fourth Five-Year Review (DEQ/EPA 2016) . Results indicated that the sediment cap is performing as designed. The next round of porewater and surface water sampling is scheduled to be conducted in 2020, before the Fifth Five-Year Review Report in 2021.

Sand covers the shoreline at lower, less steep elevations, and significant amounts of large driftwood have accumulated to help create wildlife habitat. Numerous wildlife species continue to be observed; various birds including Canada geese, gulls, cormorants, pigeons, blue herons, ospreys, and hawks were observed in 2017. The public frequents the shoreline for recreation, most commonly for walking dogs. Infrequent and minor instances of vandalism and littering have been noted, including car parts that were abandoned along the west fence line. Rounded gravel used to fill voids within the ACB has created a more stable substrate for wildlife and a consistent, safer walking surface for public use, although much of the gravel has been eroded from the upper potions of the ACB.

4.0 GROUNDWATER PERFORMANCE STANDARDS AND ACTIVITIES

This section summarizes groundwater performance standards and activities for the reporting period January 1, 2017, through December 31, 2017. Groundwater remedy observations and maintenance activities were conducted according to the O&M Plan (HC/GSI 2016). Manual NAPL and groundwater level data were collected during the site-wide semiannual monitoring events conducted on June 21, 2017, and September 19, 2017.

4.1 Groundwater Performance Standards

The groundwater remedy consists of groundwater monitoring, NAPL recovery, a subsurface barrier wall surrounding approximately 18 acres beneath the footprint of the upland soil cap, and ICs. NAPL recovery was terminated by the EPA and DEQ in 2011 because the performance standard for NAPL recovery was met: recovery rates were minimal and remaining NAPL at the site does not pose a threat to the Willamette River. ICs have yet to be completed to restrict groundwater use at the site.

Groundwater within and outside of the subsurface barrier wall remains contaminated with metals, PCP, PAHs, dioxins, and NAPL. Contaminated groundwater within the barrier wall is contained and is not migrating to the river. Outside the barrier wall, residual product in soil within the Former Waste Disposal Area (FWDA) results in elevated concentrations of PCP and PAHs and the presence of localized NAPL in groundwater. Despite the groundwater contamination in this area, monitoring of downgradient wells, surface water, and the sediment cap (inter-armoring, sub-armoring, and porewater in the organophilic clay) has demonstrated that the groundwater remedy is performing as designed and that groundwater is not adversely affecting the river.

The performance standards for the subsurface barrier wall are as follows.

- Maintain contaminant concentrations in shallow, downgradient compliance wells (or sediment porewater) below the alternate concentration limits (ACLs) set forth in the ROD (EPA 1996):
  - Arsenic (III): 1,000 µg/L
  - Chromium (III): 1,000 µg/L
  - Copper: 1,000 µg/L
  - Zinc: 1,000 µg/L
  - PCP: 5,000 µg/L
  - Total PAHs: 43,000 µg/L
  - Dioxins/furans: 0.2 ng/L
- Minimize the transport of NAPL and communication of groundwater zones across the subsurface barrier wall.
- Minimize visible discharge of creosote to the Willamette River.
- Maintain contaminant concentrations in the Willamette River below background concentrations or less than the sediment cap performance standards for surface water.

As discussed in Section 6 of the Second Five-Year Review Report (DEQ/EPA 2006), the EPA determined that ACLs were not valid as substitutes for the EPA's MCLs in groundwater. Because of this determination, the DEQ and EPA anticipate that amended groundwater cleanup goals for the site will be established in a ROD Amendment consistent with groundwater cleanup goals for the Portland Harbor Superfund Site ROD, which was issued In January 2017 (EPA 2017). After new groundwater cleanup goals are established in a ROD Amendment, the Final O&M Plan will be revised to reflect the new cleanup goals.

4.2 Groundwater Flow Direction and Gradient Assessment

Manual NAPL and groundwater level data were collected during site-wide semiannual monitoring events conducted on June 21, 2017, and September 19, 2017; continuous water levels were also collected using transducers installed in selected monitoring wells. The current monitoring well network is shown on Figure 4-1. This section summarizes groundwater flow based on the 2017 water level measurements.

4.2.1 Horizontal Flow Direction and Gradients

Manual fluid measurements were collected during or immediately following low tide in the Willamette River. Shallow groundwater elevation contour maps were developed for each semiannual event during what is typically the seasonal high (June) and low (September) river stage (Figures 4-2 and 4-3, respectively). Due to a particularly wet winter and spring, higher river levels were observed between

March and early June than during the mid-June monitoring event. The September 2017 monitoring event was coincident with the seasonal low river stage. The groundwater and NAPL elevation data are included in Table 4-1 (June 21, 2017) and Table 4-2 (September 19, 2017).

As shown in the shallow groundwater contour maps (Figures 4-2 and 4-3), the shallow horizontal groundwater gradient within the barrier wall is independent of the gradient outside the barrier wall. This demonstrates that the barrier wall has effectively cut off the hydraulic connection between the shallow groundwater zone inside and outside of the barrier wall. The groundwater gradient inside the barrier wall remains relatively flat (typically less than 0.002 foot per foot [ft/ft]) compared to the slightly steeper groundwater gradients (ranging from 0.002 ft/ft to 0.03 ft/ft) outside the barrier wall that are directed westerly toward the river and Willamette Cove. Previous water level measurements indicate when the Willamette River reaches approximately 12 to 15 feet NAVD88 (typical during prolonged periods of regional rainfall and spring snowmelt), the gradient partially reverses within the barrier wall near MW-36s in the northwest corner. This is because of a deep hydraulic connection through sand at the base of the western edge of the barrier wall; when the river level exceeds the groundwater level within the barrier wall area, an upward vertical gradient results. Due to a particularly wet winter and spring, the Willamette River stage peaked earlier in 2017 than usual, between March and early June when there was a reversal of gradient within the barrier wall. Additionally, the Willamette River stage only just raised higher than the barrier wall between March 25 and March 31, 2017. When the semiannual monitoring event in mid-June occurred, the Willamette River stage was declining and the groundwater gradient flow was flat but no longer reversed within the barrier wall. The gradient within the barrier wall area in June, with a 0.5-foot variation between MW-48s in the eastern end and MW-36s in the western end, was notably less (flatter) than the 3.7-foot variation in September.

Historical and annual hydrographs were prepared using the 30-minute pressure transducer data from paired monitoring wells located inside and outside the barrier wall as shown on Figures 4-4 through 4-11. The 11 site wells containing transducers are shown on Figure 4-1 and include two shallow and deep paired well clusters (MW-36s/37s, MW-36d/37d, MW-44s/45s, and MW-44d/45d) along the riverfront portion of the barrier wall, one shallow well pair (MW-52s/53s) on the upland side of the barrier wall, and one shallow interior well (EW-1s). The hydrographs compare water level elevations for selected well pairs to river stage elevation[1] and precipitation data[2]. The hydrographs show water levels in wells through the September 2017 semiannual monitoring event. Water level data beyond

[1] River stage data were recorded every 30 minutes from US Geological Survey (USGS) station number 14211720 (USGS 2017a). This station is located on the upstream side of the Morrison Bridge (River Mile [RM] 12.8). River stage elevation data reported by the USGS are relative to the Portland River Datum at this location. The river stage data are corrected to NAVD88 at the site (approximately RM 7) by adding 5.001 feet to the USGS reading.
[2] Precipitation data shown on Figures 4-4 through 4-11 were obtained from the Astor Elementary School rain gauge located approximately 0.5 mile from the site. Daily totals were obtained from the City of Portland Hydra Network available on the USGS Web site (USGS 2017b).

this date will be included in the 2018 Annual Report. Breaks in the monitoring well data occur when a transducer malfunctions, as further discussed in Section 4.4.

The hydrographs document groundwater elevation differences and assess barrier wall performance over time. Clear differences in the groundwater elevations between shallow wells within, and directly outside of the barrier wall demonstrate that the barrier wall is effectively isolating the groundwater within the barrier wall.

4.2.2 Vertical Flow Direction and Gradients

Vertical gradients inside and outside the barrier wall along the Willamette River were observed in monitoring well clusters MW-36/MW-37 and MW-44/MW-45. The hydrographs for these wells (Figures 4-8 through 4-11) indicate that the deep groundwater zone is in direct hydraulic connection with the river. The deep zone both inside and outside of the barrier wall closely mimics the river stage, both in elevation and timing, with small vertical gradient changes that occur in response to the daily tidal changes and seasonal river stage trends. The exterior shallow wells, also in hydraulic connection with the river, show about a quarter cycle delay from river fluctuations and have dampened amplitude in comparison with the deeper wells.

The muted or nonexistent response of interior shallow wells compared with the deep zone wells suggests a clear hydraulic disconnect between the shallow aquifer within the barrier wall and the deeper water-bearing zones. The location where the response is greatest, but still significantly muted, is in well MW-36s (Figures 4-6 through 4-9), where a hydraulic connection exists at the base of the barrier wall. While a muted response of well MW-36s to changes in daily river stage elevation is still observed, water levels in the shallow interior wells MW-44s and EW-1s are virtually nonresponsive to the daily changes in the Willamette River stage (Figures 4-10 and 4-11 for MW-44s, and Figures 4-6 and 4-7 for EW-1s). This reflects the presence of a confining silt layer between the shallow and intermediate zones near wells MW-44 and EW-1s.

Although precipitation in the Willamette River watershed ultimately affects the stage of the river, direct precipitation near the site appears to play a minor role in determining the water levels of wells within the barrier wall and along the river. The Resource Conservation and Recovery Act (RCRA)-style soil cap was designed to divert precipitation so that little infiltration occurs within the barrier wall. Although some infiltration occurs along the fringes of the soil cap and within the riparian zone, the volume of infiltration is minimal. Between the barrier wall and the river, precipitation inputs are vastly overshadowed by the response of groundwater to variations in river stage. The shallow zone up-gradient or cross-gradient from the barrier wall appears to react subtly to precipitation and is less connected to the river because of its distance from the river and the presence of the barrier wall, which is sealed into the underlying silt. One location where infiltration may influence groundwater elevation and flow path is in the retention pond (Figure 1-3) that receives diverted runoff from the soil cap. Historical water level data indicates that the groundwater gradient in this area is flat, and that there may be a slight groundwater mound east of the soil cap.

The hydrographs illustrate a net vertical gradient between the shallow and deep water-bearing zones, which continues to be slightly downward inside the barrier wall, similar to vertical gradients measured in 2008 through 2016. The net downward gradient is greater inside the barrier wall because the net shallow groundwater elevation inside the barrier wall continues to be slightly elevated compared to the net river stage. The net vertical gradient outside the barrier wall on the river side is small and varies upward and downward according to the trends of the Willamette River. Neutral or upward vertical gradients occurred when the river stage was at a higher elevation for a prolonged period, which occurred several times between March and June 2017.

4.3 NAPL Gauging and Monitoring Assessment

Between February 1993 and April 2011, approximately 6,550 gallons of NAPL were extracted from site wells. Because recovery was slow and there was uncertainty about the benefits of ongoing recovery, a NAPL investigation in the FWDA outside the barrier wall (the remaining area with active NAPL recovery) was conducted in 2011. Based on the findings from the NAPL investigation (Dense Non-aqueous Phase Liquid [DNAPL] Data Gap Investigation; HC/GSI 2011a) and extensive monitoring of the sediment cap (described in the Third Five-Year Review Report [DEQ/EPA 2011]), the DEQ and EPA decided to discontinue NAPL extraction on April 20, 2011. Subsequent monitoring of the post-extraction NAPL thickness in the FWDA was conducted in 2011 (HC/GSI 2011a), and the results supported the regulatory decision and confirmed that the residual NAPL in the FWDA is isolated and stable and does not pose a risk to the Willamette River. To confirm that this remains the case and to continue to evaluate the functional performance of the barrier wall and soil cap, NAPL presence and thickness continues to be monitored during the semiannual monitoring events.

Measurable quantities of NAPL were present in 11 site wells (EW-1s, EW-8s, EW-10s, EW-15s, EW-18s, EW-23s, MW-20i, MW-22i, MW-56s, MW-Ds, and MW-Gs) gauged semiannually in 2017. Figures 4-12 and 4-13 show the locations of wells that contained measurable quantities of light NAPL (LNAPL) and/or DNAPL for the June and September 2017 monitoring events, respectively. Tables 4-1 and 4-2 provide semiannual NAPL gauging measurements. Figures 4-14 through 4-24 show the NAPL and groundwater elevations versus time in individual wells that routinely contain NAPL. The screened interval elevations and the well depth are also shown. The thickness of LNAPL can be calculated by subtracting the LNAPL elevation (when LNAPL is present) from the groundwater elevation. Similarly, the DNAPL thickness is represented by the difference between the DNAPL elevation and the well depth elevation.

Given that NAPL within the barrier wall is constrained laterally by the barrier wall, NAPL observations within and outside of the barrier wall are discussed separately below.

4.3.1 Outside the Barrier Wall

The only area where NAPL is observed routinely outside of the barrier wall is next to the northwest corner of the enclosure (Figure 1-3) that corresponds to the FWDA (Figure 1-5). In 2017, measurable quantities of DNAPL were observed in four wells (EW-10s, MW-20i, MW-Ds, and MW-Gs) in this area. As shown on Figures 4-14 through 4-17, the DNAPL thicknesses measured in these wells in 2017 are generally stable since NAPL recovery was discontinued in April 2011. This is consistent with historical observations and supports the conclusion that NAPL observed in the FWDA is localized and stable. There is no evidence of NAPL mobility either across the barrier wall or to the Willamette River.

4.3.2 Inside the Barrier Wall

During semiannual monitoring, measurable LNAPL was present in three wells (EW-15s, EW-23s and MW-56s) within the barrier wall. Figures 4-18 through 4-20 show the elevation of LNAPL and shallow groundwater versus time in wells EW-15s, EW-23s, and MW-56s, respectively. As shown in these figures, the LNAPL thickness is generally greater when the groundwater elevation is low. This is the result of gravity drainage of LNAPL through the unsaturated zone when the water table drops. This pattern has been consistent since mid-2006 when LNAPL ceased being recovered inside of the barrier wall (i.e., LNAPL thickness was not disturbed by recovery). Although the LNAPL thickness varies cyclically with changes in the groundwater elevation, the overall LNAPL thickness in these wells has remained relatively stable, with slight increases in monitoring wells EW-15s andEW-23s during low groundwater levels.

DNAPL was detected during the 2017 semiannual monitoring events within the barrier wall near the former TFA (Figure 1-5) in wells EW-1s, MW-22i, EW-8s, and EW-18s, as shown on Figures 4-21 through 4-24, respectively. The DNAPL thickness in well EW-1s (Figure 4-21) has increased to a thickness of approximately 8 feet since mid-2011, after termination of a temporary recovery period in April 2011. The DNAPL thickness in well MW-22i is approximately 7 feet thick (Figure 4-22). Historically, DNAPL measurements in this well have been shown through extraction to be triggered by the presence of floating pin-sized globules of DNAPL and not a continuous layer of pure DNAPL. In well EW-8s, the DNAPL thickness has been generally stable since 2012, with about 2 feet of DNAPL observed in the sump of the well (Figure 4-23). The DNAPL thickness in EW-18s has been generally stable around 2 feet since 2012 (Figure 4-24).

Overall, both LNAPL and DNAPL appear to be stable and there is no evidence of their mobility either across the barrier wall or to the Willamette River.

4.4 Groundwater Remedy Maintenance Activities

Table 4-3 provides the groundwater O&M activities conducted in 2017. Transducer data loggers were inspected during the semiannual monitoring events in 2017. Due to the age of the transducers for the site, transducer malfunctions had been increasing over time, resulting in the data breaks shown in Figures 4-4 through 4-11. Over the span of three years in 2014 to 2016, all of the transducers used on the site have been replaced with new ones.

The break in MW-52s data (Figure 4-5) occurred as a result of water damage in the probe, which was identified in the June semiannual event. The transducer was sent in for repairs and re-installed in August. Currently, all transducers at the site are functional and installed in the wells shown on Figure 4-1.

4.5 Summary of Groundwater Remedy Performance

Hydraulic conditions are consistent with previous years, verifying that the remedy continues to function as designed. Groundwater monitoring data are used to understand groundwater flow conditions inside and outside of the barrier wall. This information is evaluated to determine whether the barrier wall and impermeable RCRA-type soil cap are functioning as designed.

There was no measurable LNAPL in wells outside the barrier wall. DNAPL was measured in four wells outside the barrier wall. The DNAPL in these wells has remained stable with some variation due to temperature and pressure (i.e., water level variation). Based on the findings from the DNAPL Data Gap Investigation (HC/GSI 2011a), subsequent monitoring of the post-extraction NAPL thicknesses in wells in the FWDA, and extensive monitoring of the sediment cap (described in the Third and Fourth Five-Year Review Report [DEQ/EPA 2011; DEQ/EPA 2016]) and groundwater, the decision to discontinue NAPL recovery is justified, and residual NAPL remaining in the FWDA does not pose a threat to the Willamette River.

Based on the evaluation of groundwater data from 2005 through 2017, the barrier wall and impermeable soil cap are functioning as designed to divert groundwater flow around and prevent rainwater infiltration into NAPL source areas contained within the barrier wall and NAPL contained within the barrier wall is prohibited from migrating to the Willamette River.

5.0 VEGETATION MANAGEMENT

This section summarizes the vegetation management and monitoring activities for the reporting period January 2017 through December 2017. Vegetation management activities on the upland cap were conducted in accordance with the McCormick and Baxter Vegetation Management Plan (HC/GSI 2011b).

The upland cap was constructed during a two-year period beginning in 2004 with the re-grading of the Willamette River bank. The 6-acre Riparian Area cap was installed and tied into the in-water sediment cap. In 2005, a 34-acre multiple-component designed soil cap was constructed to complete the upland cap. The City of Portland Bureau of Environmental Services (BES) entered into an Intergovernmental Agreement (IGA) with the DEQ to provide vegetation planning and vegetation management services for the upland cap from 2005 through 2010. In February 2006, the soil cap was planted with native grasses, plants, and trees, and an irrigation system was installed. After the fifth growing season, BES determined that the vegetation was fully established and the irrigation system was no longer needed.

Overall, the planting and vegetation management goals have been met. The irrigation system and piping had been inactive since 2009 and were decommissioned in December 2015. Semiannual noxious weed control activities, including herbicide application, were conducted from spring 2006 through spring 2013. Herbicide application was temporarily discontinued in June 2013 when nearby desirable native vegetation was observed to be stressed and dying. No herbicide was applied in 2014 and 2015, but was resumed in 2016 after noxious weeds appeared to be spreading. One herbicide application was completed in May 2017.

Rodents that inhabit the cap have damaged vegetation in the past; however, with the exception of some earlier targeted damage to the grand fir (*Abies grandis*) seedlings (BES 2010), there has been insignificant damage to other plantings. Rodent activities are monitored during quarterly site inspections and were not observed to be causing significant damage during site visits in 2017

5.1 Vegetation Management Components and Goals

The upland cap has five distinct components, each with corresponding goals and objectives for managing hydrology, soil, and wildlife habitat (Figure 5-1). These components are:

- Entrance Area;
- Impermeable Cap;
- Riparian Area;
- Stormwater Retention Pond and Drainage Swale; and
- Earthen Cap.

Performance standards to assess whether the planting goals in the DEQ/BES IGA for the entire upland cap are met include:

- Bare soil spaces are small and well dispersed;
- Soil movement, such as active rills or gullies and soil deposition around plants or in small basins, is absent or slight and local;
- Plant litter is well distributed and effective in protecting the soil with few or no litter dams present;
- Native woody and herbaceous vegetation and germination micro-sites are present and well distributed across the site;
- Vegetation structure results in rooting throughout the available soil profile;
- Plants have normal, vigorous growth form and a high probability of remaining vigorous, healthy, and dominant over undesired competing vegetation;
- Stream banks have less than 5 percent exposed soil with margins anchored by deeply rooted vegetation or coarse-grained alluvial debris; and
- A continuous corridor of shrubs and trees provides shade for the entire stream bank.

Specific goals were set for planting the Riparian Area to create habitat, including elements such as large woody material, riparian vegetation for food, habitat cover and shelter, and shading (NOAA 2004).

5.2 Baseline Conditions

In 2010, the BES determined that the vegetation had been fully established, as discussed in its final 2010 Vegetation Management Report (BES 2010). Hart Crowser assumed responsibility for the vegetation management at that time. On June 10, 2011, a Hart Crowser ecologist inspected the upland cap to confirm the vegetation conditions discussed in the report. The inspection included visual observation of vegetation planting areas, species identification (native, non-native, and invasive), growth, density, general coverage, and relative health of vegetation throughout the site. Photograph documentation of the inspection was completed to establish a baseline to evaluate the progress of future vegetation treatments and the qualitative observations at select site locations. These locations or “Photo Stations” are shown on Figure 5-1 and the photographs are provided in Appendix C, Vegetation Photograph Log. The following sections summarize the initial conditions and observations made during the baseline visit in June 2011.

5.2.1 Riparian Area

The Riparian Area is divided into two components: upper and lower. Each component received similar vegetation treatments. The lower component is subject to Willamette River stage fluctuations, which influence vegetation conditions at its lower edge during high-water events.

Lower Component. The lower component originally was planted with a variety of native trees and shrubs including: Oregon ash (*Fraxinus latifolia*), black hawthorn (*Crataegus suksdorfii*), cascara (*Rhamnus purshiana*), hardhack (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), Pacific ninebark (*Physocarpus capitatus*), swamp rose (*Rosa pisocarpa*), river willow (*Salix fluviatilis*), Sitka willow (*Salix sitchensis*), rigid willow (*Salix rigida*), Piper’s willow (*Salix piperi*), and black twinberry (*Lonicera involucrata*). Groundcover species planted in the lower component included: California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), meadow barley (*Hordeum brachyantherum*), slender hairgrass (*Deschampsia elongata*), spike bentgrass (*Agrostis exerata*), globe gilia (*Gilia capitata*), lupine (*Lupinus albicaulis*), and Canada goldenrod (*Solidago canadensis*). Tree plantings were not installed at lower elevations in the lower component of the Riparian Area because of the potential for late season inundation from high river levels. Instead, appropriate shrubs, primarily willows, were installed along the lower edge of this component to provide food and shade. A significant quantity of large woody debris was observed along the entire length of the lower edge. Trees and shrubs within the lower component were observed to be well established and growing both vertically and laterally. No indications of stress were noted. Localized areas of exposed TRM were observed along the length of the lower edge of the TRM, likely because of river fluctuations and movement of large woody debris along the shoreline. Thistle (*Cirsium arvense*) was the most common noxious weed with lesser quantities of knapweed (*Centaurea Sp.*) and butterfly bush (*Buddleia davidii*) present.

Upper Component. The upper component was planted with native vegetation including: red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*), Western red cedar (*Thuja plicata*), madrone (*Arbutus menziesii*), grand fir, Garry oak (*Quercus garryana*), Oregon ash, black hawthorn, cascara, red elderberry (*Sambucus racemosa*), blue elderberry (*Sambucus cerulea*), Nootka rose (*Rosa nutkana*), tall Oregon-grape, snowberry (*Symphoricarpos albus*), red-flowering currant (*Ribes sanguineum*), oceanspray (*Holodiscus discolor*), red-osier dogwood, twinberry, and Pacific ninebark. Groundcover species in the upper component are identical to those in the lower component. Similar to the lower component, trees and shrubs were well established and appeared healthy. In 2011, trees were 6 to

12 feet tall. Few areas containing bare ground were observed. Thistle and knapweed were present in small quantities among the groundcover plantings throughout the upper component.

Summary. In general, the Riparian Area components appeared to be performing well, with the installed trees and shrubs looking healthy and spreading. Groundcover species provided relatively good coverage of the soil, with the exception of a few areas containing bare ground and observed TRM along the shoreline. In addition, large driftwood was present throughout the lower component and in smaller quantities within the upper component. Thistle, knapweed, and butterfly bush continue to grow within the Riparian Area.

5.2.2 Upland Area

The Upland Area is divided into three components—the earthen cap, the stormwater retention pond/drainage swale, and the impermeable cap (Figure 5-1). A variety of native trees, shrubs, and herbaceous species are present on the earthen cap as shown in photos captured at Photo Stations 1, 2, 3, and 5 (Appendix C). Native shrubs and herbaceous species are present in the stormwater retention pond/drainage swale (Photo Station 4, Appendix C). Meadow grasses and herbs are present on the impermeable cap (Photo Station 6, Appendix C).

Earthen Cap Component. Originally, this component was planted with a variety of native trees, shrubs, and grasses including: Garry oak, Ponderosa pine (*Pinus ponderosa*), black hawthorne (*Crataegus douglasii*), madrone, snowberry, blue elderberry (*Sambucus cerulea*), Oregon-grape (*Mahonia aquifolium*), Nootka rose, red-flowering currant, oceanspray, serviceberry (*Amelanchier alnifolia*), and mock orange (*Philadelphus lewisii*). Herbaceous species installed on the earthen cap included chewings fescue (*Festuca rubra var. comutata*), California brome, meadow barley, slender hairgrass, Spanish clover (*Lotus purshiana*), claria (*Clarkia amoena*), globe gilia, meadow checkermallow (*Sidalcea campestris*), large-leaved lupine (*Lupinus polyphullus*), and Canada goldenrod. By 2011, nearly all of these plant varieties remained on the earthen cap and appear to be well established and growing both vertically and laterally. Nootka rose had dominated the northwest corner of the earthen cap component; however, some of the Nootka rose appeared to have been highly stressed or had died, and most were regenerating. The black hawthorn had grown to 6 to 8 feet tall. Localized areas of moss were observed within the grasses and herbaceous vegetation. Small quantities of knapweed and thistle were also present.

Stormwater Retention Pond/Drainage Swale Component. This component was planted with a native shrub overstory consisting of hardhack, Sitka willow, and Piper's willow (Photograph 4, Appendix C). Volunteer red alder and black cottonwood (*Populus balsamifera*) were observed among the shrub plantings. Understory herbaceous species were planted in the pond and swale area based on anticipated inundation within the pond and swale area and included: water plantain (*Alisma plantago aquatica*), slough sedge (*Carex obnupta*), soft stem bulrush (*Scirpus tabernaemontanii*), small-fruited bulrush (*Scirpus microcarpus*), Western sloughgrass (*Beckmania syzigachne*), Western mannagrass (*Glyeria occidentalis*), tufted hairgrass (*Deschapsia cespitosa*), slender hairgrass, meadow barley, spike bentgrass, meadow foxtail (*Alopecuris geniculatus*), self heal (*Prunella vulgaris*), Spanish clover, and gumweed (*Grindelia integrifolia*). The shrub plantings in the pond and swale area were well established and appeared healthy. Many of the grasses and herbs in the pond area did not survive because the infiltration of surface runoff limits moisture and the understory is dominated by sand and bare ground. Given that the shrubs were well established, the area is flat, and erosion generally was not occurring, replanting grasses and herbs was not recommended. No noxious weeds were observed in this component.

Impermeable Cap Component. This component was seeded with a grassland mixture including: chewings fescue, California brome, meadow barley, slender hairgrass, large-leaved collomia (*Collomia grandiflora*), globe gilia, large-leaved lupine, and Canada goldenrod. Grassland species provided excellent cover of the impermeable cap. Moss was present in localized areas where grasses and herbs did not become established. Small quantities of knapweed, thistle, skeletonweed (*Chondrilla juncea*), and dandelion (*Taraxacum officinale*) were present within the southwestern portion of this component and did not appear to be encroaching on desirable vegetation.

Summary. In general, the Upland Area appeared to be performing well in 2011 (baseline conditions) with the installed trees and shrubs looking healthy and spreading on the earthen cap component, shrubs well established within the stormwater retention pond/drainage swale component, and good soil coverage and vegetative diversity on the impermeable cap component. Groundcover species provided excellent coverage of the ground, with the exception of a few sections containing bare ground and the relatively bare understory in the pond area. Limited quantities of noxious weeds were observed in the Upland Area and were primarily limited to the southwestern edge of the impermeable cap component.

5.3 Vegetation Observations

On June 30 and November 11, 2017, Hart Crowser inspected the upland cap to assess the current conditions as compared to the baseline conditions observed in June 2011. Qualitative data were recorded on species composition, cover and density of vegetation, growth and vigor, and effectiveness of previous noxious weed treatments. The Photograph Log shows select Photo Stations during the June 2017 inspection and are paired with photographs from the June 2011 baseline inspection for a qualitative assessment of the site. Photo Stations are shown on Figure 5-1. Observations are summarized below.

5.3.1 Riparian Area

Lower Component. Trees and shrubs in the lower component were observed to be well established and growing both vertically and laterally. Many of the trees and shrubs planted in this area have reached a height of 9 to 20 plus feet. The area has good grass coverage and no barren areas were visible. As the tree species continue to develop, they will increase shading along the shoreline of the river. Most of the deciduous trees appear healthy and recovered well from the 2015 drought, although a few stressed maple trees were observed. Most of shrubs planted during the TRM repairs in December 2015 have perished as a result of high winter river levels and summer drought; however, groundcover is returning to the area following placement of the mulch and soil beneath the TRM. Sediment and debris accumulation above the ACB is also helping to reestablish groundcover in the area.

The spring herbicide application was successful at treating the black mustard (Brassica nigra), scotch broom (*Cytisus scoparius*), knapweed and Canada thistle (*Cirsium arvense*); however, some thistle was still observed in the lower portion of the Riparian Area. Currently, an herbicide application is not planned for 2018. Following the June 2018 vegetation inspection, the necessity of additional weed control activities will be assessed.

Localized areas of exposed TRM are still visible along the length of the lower edge of the TRM, but grasses and weeds are beginning to infill the areas following the December 2015 repairs. A significant quantity of large driftwood was observed along the entire length of the lower component of the Riparian Area in June and October 2017.

Upper Component. Native trees and shrubs in the upper component continue to recover following the drought in 2015. Ponderosa pine, madrone, Nootka rose, snowberry, Oregon-grape, Douglas Hawthorne, and elderberry appeared well established and performing best within this component. Grand Fir have not recovered following the drought in 2015. Approximately 80 to 90 percent of the Grand Fir have perished while most of the others exhibit signs of drought stress, as well as possible disease and/or pest infestation. It is not unusual for Grand Fir to be prone to drought stress, they also are known to sometimes struggle in the Willamette Valley.

Following a period of dry weather in July and August, approximately 2,500 gallons of water were applied to the Riparian Area on August 8, 2017. The water was applied to avoid excessive late season drought stress that was experienced in 2015 and to a lesser degree, 2016.

Volunteer madrones and live oak were present along the fence and appear to be thriving. Individual plants, including oceanspray, cascara, twinberry, and Pacific ninebark, continue to grow well. Groundcover plantings also appeared healthy and fewer weeds were observed; however, thistle and St. John's Wort were still present.

Summary. In general, the upper and lower components appeared to be performing well with the trees and shrubs generally recovering from somewhat drier than normal summers. Only the Grand Fir seem to have been significantly impacted by the recent dry weather. Groundcover species are providing good coverage of the site soils; no areas of bare ground were observed. In general, the canopy in the north portion of the Riparian Area is much denser when compared to the south.

Most of the shrubs planted in December 2015 did not survive, which was not unexpected given that the area is relatively dry and the irrigation system has been decommissioned. Regular manual watering of the plants would not have been cost effective. High winter and spring river levels also appear to have damaged the plantings. The primary goal of the repairs, however, was to stabilize the TRM, which appears to have been successful. Large driftwood continues to accumulate along the shoreline to the middle of the bank near the break between the upper and lower components (Photographs 7 and 9, Appendix C). This large driftwood provides habitat for birds, small mammals, and other wildlife using this portion of the site.

Scattered noxious weeds continue to grow in the Riparian Area, but their abundance was significantly reduced by the spring herbicide application. The need for additional herbicide applications will be evaluated following the June 2018 vegetation inspection.

5.3.2 Upland Area

Earthen Cap Component. Tree and shrub plantings on the earthen cap were healthy and growing well (Photographs 2, 3, and 5, Appendix C). Ponderosa pine, Oregon grape, elderberry, lupine, and serviceberry continue to be performing the best. Nootka rose dominated the northwest portion of the earthen cap. Trees and shrubs ranged in height from approximately 6 to 15 plus feet. Herbaceous species provided full coverage of the ground. During our June 2017 site visit, gumweed, mullein, and goldenrod and various grasses were frequently observed throughout the earthen cap. No indications of significant stress were observed and oak tress appear to have recovered following recent dry summers. Localized areas of moss were observed in the herbaceous layer. Scattered areas of noxious weeds continue to be observed, but recent herbicide applications have been effective at reducing the weed density.

Stormwater Retention Pond/Drainage Swale Component. Vegetation in the drainage swale area was well established and appeared healthy, but most shrubs were either highly stressed or dead within the stormwater retention pond and riprap-lined outlet (Photograph 4, Appendix C). Red-osier dogwood volunteers were observed within the northwest portion of the swale. Sitka willow had grown to 10 to 15 feet tall, and the Piper's willow were 6 to 8 feet tall. Volunteer cottonwoods were observed to range from 20 to 25 feet tall. Alder and willow were present and expanding around the periphery of the stormwater retention pond, but some dead and stressed shrubs were observed in the pond and its outlet (Photograph 4, Appendix C). Most of the herbaceous and emergent plantings in this component did not survive because of the sandy nature of the soil, which does not provide adequate moisture retention and inundation to support all of the originally installed plant species during the dry months of the year. Various grasses make up nearly all of the groundcover in the retention pond; however, a few bare areas were observed.

Impermeable Cap Component. The grassland species on the impermeable cap provided excellent coverage of the ground (Photograph 6, Appendix C). Gumweed was observed along the southwestern edge of the impermeable cap and provides increased diversity in this area. The remaining grasses and herbs were thriving. The spring 2017 herbicide treatment continued to shrink populations of scotch broom, knapweed, thistle, and skeleton weed that were observed on the cap. During the late spring, lupine appeared to be thriving, as an impressive spring bloom was observed.

Summary. The Upland Area components were performing well with the exception of small areas of alder and willow in the stormwater retention pond and its riprap-lined outlet channel. Groundcover (herbaceous) species provided excellent coverage of the ground with the exception of a few areas containing bare ground and the relatively bare understory in the pond area. Noxious weed density decreased following the spring herbicide application. The necessity of additional treatments will be evaluated following the June 2018 vegetation inspection.

5.4 Vegetation Maintenance Activities

This section describes activities conducted to maintain vegetation in 2017. The general planting goals (NOAA 2004) continue to be met.

5.4.1 Noxious Weed Control

A preventive control approach continues to be implemented as part of an ongoing effort to control the spread of noxious weed species. Spot spraying was last completed over the entire site in May 2017. This follows weed suppression efforts in spring and fall 2016. Vegetation inspections in June and October found that noxious weed populations had been reduced. Various noxious weeds continue to be observed throughout the site, but at numbers that aren't significantly inhibiting growth of native plants. Future weed control efforts will be evaluated following the June 2018 vegetation inspection.

5.4.2 Irrigation

Irrigation was suspended in 2011 and the system decommissioned in the spring of 2015. Due to exceptionally dry conditions during spring and summer 2015, irrigation water was applied throughout the upper and lower Riparian Areas to help alleviate stressed vegetation. Watering was also completed during the summer of 2016. The 2017 summer was not as hot and dry, but as a precautionary measure, one watering event was completed on August 8, 2017, when 2,500 gallons of water were applied to the Riparian Area following a stretch of hot weather. The watering targeted all stressed trees and shrubs, although greater emphasis was placed on the vegetation that appeared to be the most stressed, which included Grand Fir, Oregon ash, red osier dogwood, and nootka rose.

It is anticipated that additional irrigation water may be needed in 2018, particularly if the site is again subject to drought conditions. It will be particularly important to provide water remaining conifers, as they appear to be the most stressed. The water tank trailer and firehose worked well to apply water throughout the site and this same technique could be used again, if needed. Conditions will be monitored during the summer months and, if dry conditions are prevalent, another drought assessment survey will be conducted to determine if additional watering is needed.

5.5 Vegetation Performance Summary

Overall, the tree, shrub, and groundcover plantings are performing well throughout the site. Although alder and willow are present along the periphery, much of the stormwater retention pond remains barren. Groundcover species provide excellent coverage over much of the site. Noxious weed coverage was reduced by the spring herbicide application, but close attention will be paid to weed populations during the 2018 vegetation inspections and noxious weed control measures will be implemented if needed.

The exceptionally dry summer conditions in 2015 resulted in significant stress of the riparian community and other localized habitats across the site. Vegetation appeared to recover in 2016 and 2017, although several conifers in the upper Riparian Area did not survive (Photograph 12; Appendix C). It is likely that some of the mortality was the result of natural competition for water and nutrients, that was acerbated by the summer 2015 drought. Although some conifers were lost, the remaining trees should face less competition, which will help them thrive. Vegetation monitoring will continue to be performed during summer 2018 and additional watering will be provided as needed for the survival of the vegetation.

6.0 SUMMARY OF OVERALL REMEDY PERFORMANCE

Overall, the 2017 soil and sediment cap observations and inspections and groundwater monitoring revealed no significant change in remedy performance or areas of concern. The remedy continues to perform as designed and is protective of human health and the environment.

7.0 SUMMARY OF PLANNED ACTIVITIES FOR 2018

The Final O&M Plan with descriptions of O&M activities and the schedule for the next 5 years was completed by the DEQ with assistance from EPA, GSI, and Hart Crowser in March 2014.

Table 7-1 presents the soil cap O&M activities planned through 2021. Soil cap O&M activities in 2018 will consist primarily of quarterly inspections and routine maintenance. Semiannual inspections should be continued in 2018 to assess and monitor vegetation planting areas, species identification (native, non-native, and invasive), growth, density, and general coverage throughout the site. The continuation of noxious weed control activities will be evaluated in June 2018. The two job trailers were removed in February 2017.

Table 7-2 presents the sediment cap O&M activities planned through 2021. In 2018, activities are expected to include quarterly inspections and routine maintenance, and possibly a beach litter cleanup.

The frequency of the groundwater monitoring activities through September 2021 are summarized in Table 7-3. The next groundwater quality sampling event will occur in 2020. Routine maintenance of the data logger transducers are also included as elements of groundwater O&M.

8.0 REFERENCES

BES 2010. Vegetation Management Report (January 2009 through December 2009), McCormick & Baxter Creosoting Company, Portland, Oregon. City of Portland, Bureau of Environmental Services (BES). January 2010.

DEQ/EPA 2006. Final Operation Second Five-Year Review Report, McCormick & Baxter Creosoting Company Superfund site. September 2006.

DEQ/EPA 2011. Draft Final Operation Third Five-Year Review Report, McCormick & Baxter Creosoting Company Superfund site. September 2011.

DEQ/EPA 2016. Fourth Five-Year Review Report, McCormick & Baxter Creosoting Company Superfund site. September 2016.

DEQ/EPA 2014. Final Operation and Maintenance Plan for the McCormick and Baxter Creosoting Company Superfund site, Portland, Oregon. March, 2014.

EPA 1996. Record of Decision, McCormick & Baxter Creosoting Company site, Portland, Oregon. March 1996.

EPA 2017. Record of Decision, Portland Harbor Superfund Site, Portland, Oregon. January 2017.

HC/GSI 2008. Subsidence in Upland Cap Memorandum, McCormick & Baxter Superfund site, Portland, Oregon. December 15, 2008.

HC/GSI 2009. Additional Subsidence Monitoring Memorandum, McCormick & Baxter Superfund site, Portland, Oregon. February 22, 2009.

HC/GSI 2011a. DNAPL Data Gap Investigation Report, McCormick & Baxter Creosoting Company site, Portland, Oregon. Prepared for Oregon Department of Environmental Quality. July 2011.

HC/GSI 2011b. Vegetation Management Plan, McCormick and Baxter Creosoting Company Superfund site, Portland, Oregon. August 2011.

HC/GSI 2016. Operation and Maintenance Manual, McCormick & Baxter Creosoting Company site, Portland, Oregon. Prepared for Oregon Department of Environmental Quality. June 2016.

NOAA 2004. Endangered Species Act - Section 7 Consultation. Biological Opinion & Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation. McCormick and Baxter Creosoting Company site, Willamette River Remediation Sediment Cap, Multnomah County, Oregon. National Marine Fisheries Service, Northwest Region. March 15, 2004.

USGS 2017a. USGS 14211720 Willamette River at Portland, OR. Provisional gage height data. 2003 to Present. Accessed at: http://waterdata.usgs.gov/nwis/uv?cb_00060=on&cb_00065=on&cb_00055=on&format=gif_default&period=60&site_no=14211720.

USGS 2017b. Astor Elementary School Rain Gage. Provisional, uncorrected raw data from the City of Portland Hydra Network. 2005 to Present. http://or.water.usgs.gov/non-usgs/bes/astor.rain.

Table 2-1: Soil Cap O&M Activities in 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2017
Visual Inspections:	
Cap surface	January, April, July, November
Subsidence near EW-1s	January, April, July, November
Stormwater conveyance system	January, April, July, November
Security fencing	January, April, July, November
Warning signs	January, April, July, November
Abundance and survival of vegetation	January, April, June, July, October, November
Routine Maintenance and Monitoring:	
Manual removal of invasive plant	May
Targeted application of herbicides	April and May
Non-Routine Maintenance:	
Riparian area water events	August
Filling of potential animal burrow into the earthen cap	Periodically along fence
Trailer removal	February
Utilities Service:	
Water	September (Backflow Testing)
Trailer power and alarm, trailer	Decommissioned in February

Table 3-1: Sediment Cap O&M Activities in 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2017
Visual Inspections (from shore):	
Warning buoys	January, April, July, November
Cap surface	January, April, July, November
Habitat quality	January, April, June, July, October, November
Routine Monitoring:	
Water column and inter-armoring water sampling	None
Organoclay core sampling	None
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	None
Non-Routine Maintenance:	
Cut ACB cable loops	Periodically

Table 4-1 - Groundwater and NAPL Elevations: June 21, 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-1s	6/21/2017	11:55	40.1		22.5	39.2		8.8	17.6
EW-2s	6/21/2017	10:45	42.4		27.5				14.8
EW-8s	6/21/2017	11:20	40.5		23.3	49.9		4.8	17.1
EW-10s	6/21/2017	9:45	29.4		15.2	41.5		1.1	14.2
EW-15s	6/21/2017	11:00	43.0	26.3	28.6		2.3		16.7
EW-18s	6/21/2017	12:05	40.7		23.5	42.6		2.1	17.2
EW-19s	6/21/2017	9:30	25.9		11.5				14.4
EW-23s	6/21/2017	11:10	37.6	21.3	21.8		0.5		16.3
MW-1r	6/21/2017	12:15	37.6		19.3				18.3
MW-7 WC[a]	6/21/2017		36.7						36.7
MW-10r	6/21/2017	11:40	41.9		24.6				17.2
MW-15s	6/21/2017	10:38	43.3		26.1				17.2
MW-17s	6/21/2017	11:02	41.3		24.2				17.1
MW-20i	6/21/2017	10:20	41.4	27.4	27.4	71.2	Trace	3.5	14.0
MW-22i	6/21/2017	11:45	42.3		27.9	51.5		7.5	14.3
MW-23d	6/21/2017	8:55	41.1		26.2				14.8
MW-32i	6/21/2017	11:20	39.3		21.2				18.2
MW-34i	6/21/2017	10:57	32.7		18.8				13.9
MW-35r	6/21/2017	9:50	32.3		17.7				14.6
MW-36d	6/21/2017	8:58	30.5		16.4				14.1
MW-36i	6/21/2017	8:54	30.2		16.1				14.1
MW-36s	6/21/2017	8:51	30.7		14.1				16.7
MW-37d	6/21/2017	9:04	26.1		12.0				14.0
MW-37i	6/21/2017	9:09	25.9		11.9				14.0
MW-37s	6/21/2017	9:12	24.9		10.6				14.2
MW-38d	6/21/2017	9:34	31.8		17.7				14.1
MW-38i	6/21/2017	9:30	32.1		17.8				14.2
MW-38s	6/21/2017	9:27	32.3		15.2				17.1
MW-39d	6/21/2017	9:39	29.8		15.7				14.1
MW-39i	6/21/2017	9:44	30.1		16.0				14.1
MW-39s	6/21/2017	9:47	29.8		15.4				14.4
MW-40d	6/21/2017	10:22	28.7		14.6				14.1
MW-40i	6/21/2017	10:18	28.7		14.6				14.1
MW-40s	6/21/2017	10:15	28.3		11.2				17.1
MW-41d	6/21/2017	10:11	27.4		13.4				14.1
MW-41i	6/21/2017	10:07	27.1		13.0				14.1
MW-41s	6/21/2017	10:04	27.8		13.5				14.2
MW-42d	6/21/2017	10:35	32.2		18.2				14.0
MW-42i	6/21/2017	10:38	32.7		18.5				14.2
MW-42s	6/21/2017	10:42	32.4		15.2				17.2
MW-43d	6/21/2017	10:45	28.3		14.3				14.1
MW-43i	6/21/2017	10:48	30.3		16.2				14.1
MW-43s	6/21/2017	10:51	31.1		16.9				14.2
MW-44d	6/21/2017	11:05	29.6		15.2				14.4
MW-44i	6/21/2017	11:08	29.3		15.3				14.0
MW-44s	6/21/2017	11:12	29.6		12.5				17.0
MW-45d	6/21/2017	11:17	27.9		13.8				14.1
MW-45i	6/21/2017	11:20	28.0		13.9				14.1
MW-45s	6/21/2017	11:14	28.2		13.8				14.3
MW-46s	6/21/2017	11:30	35.5		18.4				17.1
MW-47s	6/21/2017	11:35	35.5		20.9				14.6
MW-48s	6/21/2017	11:46	38.7		21.5				17.2
MW-49s	6/21/2017	11:49	37.6		16.5				21.1
MW-50s	6/21/2017	8:45	39.3		22.2				17.1

Table 4-1 - Groundwater and NAPL Elevations: June 21, 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-51s	6/21/2017	8:40	39.5		18.3				21.2
MW-52s	6/21/2017	10:48	40.7		23.5				17.2
MW-53s	6/21/2017	10:50	40.4		19.7				20.8
MW-54s	6/21/2017	10:18	41.8		24.6				17.2
MW-55s	6/21/2017	10:20	41.0		22.4				18.6
MW-56s	6/21/2017	11:30	43.5	26.5	26.5		Trace		16.9
MW-57s	6/21/2017	10:26	42.0		26.9				15.2
MW-58d	6/21/2017	9:37	41.4		27.3				14.1
MW-58i	6/21/2017	9:35	41.0		26.9				14.1
MW-58s	6/21/2017	9:30	41.5		27.2				14.3
MW-59s	6/21/2017	11:50	35.9		16.7				19.2
MW-60d	6/21/2017	8:39	40.1		26.0				14.1
MW-61s	6/21/2017	10:02	43.6		24.2				19.4
MW-62i	6/21/2017	10:34	42.6		28.6				14.0
MW-As	6/21/2017	11:28	39.3		18.9				20.4
MW-Ds	6/21/2017	10:40	42.9	28.0	28.0	36.9	Trace	1.7	14.9
MW-Gs	6/21/2017	10:00	40.2	25.7	25.7	42.7	Trace	2.0	14.5
MW-Os	6/21/2017	8:30	40.9		19.8				21.1
PW-1d	6/21/2017	11:20	44.0		25.9				18.1
PW-2d	6/21/2017	8:10	41.8		23.7				18.1

NM = not measured
LNAPL specific gravity estimated as 0.981 g/cm^3
Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater
[a]Unable to access MW-7 WC.

Table 4-2 - Groundwater and NAPL Elevations: September 17, 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID[a]	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
EW-1s	9/17/2017	10:35	40.1		24.4	40.0		8.0	15.7
EW-2s	9/17/2017	9:30	42.4		33.6				8.8
EW-8s	9/17/2017	10:50	40.5		25.5	52.8		1.9	14.9
EW-10s	9/17/2017	9:05	29.4		20.9	41.5		1.2	8.6
EW-15s	9/17/2017	10:10	43.0	30.3	41.2		10.8		12.5
EW-18s	9/17/2017	10:40	40.7		25.8	42.0		2.7	15.0
EW-19s	9/17/2017	8:55	25.9		17.4				8.5
EW-23s	9/17/2017	9:55	37.6	25.6	28.6		3.0		12.0
MW-1r	9/17/2017	11:00	37.6		25.2				12.4
MW-7 WC[a]	9/17/2017	9:47	36.7		25.5				11.2
MW-10r	9/17/2017	10:25	41.9		27.0				14.9
MW-15s	9/17/2017	10:40	43.3		29.0				14.3
MW-17s	9/17/2017	11:13	41.3		27.3				14.0
MW-20i	9/17/2017	9:20	41.4		33.1	70.7		4.0	8.4
MW-22i	9/17/2017	10:30	42.3		33.2	51.6		7.4	9.0
MW-23d	9/17/2017	10:48	41.1		32.2				8.8
MW-32i	9/17/2017	11:06	39.3		26.9				12.4
MW-34i	9/17/2017	9:32	32.7		24.3				8.3
MW-35r	9/17/2017	11:37	32.3		22.8				9.5
MW-36d	9/17/2017	9:08	30.5		22.0				8.5
MW-36i	9/17/2017	9:04	30.2		21.6				8.6
MW-36s	9/17/2017	9:01	30.7		18.5				12.2
MW-37d	9/17/2017	9:17	26.1		17.7				8.4
MW-37i	9/17/2017	9:13	25.9		17.4				8.4
MW-37s	9/17/2017	9:11	24.9		16.4				8.5
MW-38d	9/17/2017	9:24	31.8		23.3				8.5
MW-38i	9/17/2017	9:28	32.1		23.1				9.0
MW-38s	9/17/2017	9:30	32.3		19.4				12.9
MW-39d	9/17/2017	9:33	29.8		21.4				8.4
MW-39i	9/17/2017	9:36	30.1		21.7				8.4
MW-39s	9/17/2017	9:38	29.8		21.0				8.7
MW-40d	9/17/2017	10:02	28.7		20.4				8.3
MW-40i	9/17/2017	10:04	28.7		20.0				8.8
MW-40s	9/17/2017	10:06	28.3		15.0				13.4
MW-41d	9/17/2017	9:59	27.4		19.1				8.3
MW-41i	9/17/2017	9:53	27.1		18.7				8.4
MW-41s	9/17/2017	9:57	27.8		19.3				8.4
MW-42d	9/17/2017	10:28	32.2		24.0				8.2
MW-42i	9/17/2017	10:26	32.7		24.2				8.4
MW-42s	9/17/2017	10:24	32.4		17.9				14.4
MW-43d	9/17/2017	10:16	28.3		20.0				8.3
MW-43i	9/17/2017	10:20	30.3		22.0				8.4
MW-43s	9/17/2017	10:22	31.1		22.5				8.6
MW-44d	9/17/2017	10:49	29.6		21.1				8.5
MW-44i	9/17/2017	10:51	29.3		20.8				8.6
MW-44s	9/17/2017	10:45	29.6		14.7				14.9
MW-45d	9/17/2017	10:41	27.9		19.6				8.3
MW-45i	9/17/2017	10:38	28.0		16.6				11.4
MW-45s	9/17/2017	10:43	28.2		19.6				8.6
MW-46s	9/17/2017	11:00	35.5		20.5				15.1
MW-47s	9/17/2017	11:03	35.5		26.9				8.6
MW-48s	9/17/2017	11:33	38.7		22.8				15.9
MW-49s	9/17/2017	11:31	37.6		19.8				17.8
MW-50s	9/17/2017	10:53	39.3		23.6				15.6

Table 4-2 - Groundwater and NAPL Elevations: September 17, 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

Well ID[a]	Date	Time	Measuring Point Elevation (ft NAVD88)	Depth to LNAPL (ft)	Depth to water (ft)	Depth to DNAPL (ft)	LNAPL Thickness (ft)	DNAPL Thickness (ft)	Groundwater Elevation LNAPL Corrected (ft NAVD88)
MW-51s	9/17/2017	10:51	39.5		21.7				17.8
MW-52s	9/17/2017	11:14	40.7		25.9				14.8
MW-53s	9/17/2017	11:22	40.4		23.7				16.8
MW-54s	9/17/2017	10:32	41.8		27.2				14.6
MW-55s	9/17/2017	10:34	41.0		27.7				13.3
MW-56s	9/17/2017	10:15	43.5	30.3	30.6		0.3		13.2
MW-57s	9/17/2017	10:37	42.0		32.5				9.5
MW-58d	9/17/2017	9:55	41.4		33.1				8.3
MW-58i	9/17/2017	9:57	41.0		32.8				8.2
MW-58s	9/17/2017	9:59	41.5		32.6				8.9
MW-59s	9/17/2017	11:23	35.9		21.8				14.1
MW-60d	9/17/2017	8:40	40.1		31.4				8.6
MW-61s	9/17/2017	10:25	43.6		30.0				13.7
MW-62i	9/17/2017	9:28	42.6		34.2				8.4
MW-As	9/17/2017	11:08	39.3		22.2				17.1
MW-Ds	9/17/2017	9:35	42.9	34.0	34.0	36.2	Trace	2.5	8.9
MW-Gs	9/17/2017	9:15	40.2	31.5	31.5	42.8	Trace	1.9	8.6
MW-Os	9/17/2017	10:58	40.9		23.0				17.9
PW-1d	9/17/2017	11:01	44.0		31.7				12.4
PW-2d	9/17/2017	10:56	41.8		29.3				12.5

LNAPL specific gravity estimated as 0.981 g/cm^3
Corrected groundwater elevation = [LNAPL thickness * LNAPL specific gravity] + groundwater

Table 4-3: Groundwater O&M Activities in 2017
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency in 2017
NAPL Monitoring:	
Manual gauging of site wells	June, October
Groundwater Monitoring:	
Downloading continuous water level data from transducers	June, October
Manual water level measurements from site wells	June, October
Routine Maintenance of Equipment:	
Replaced Transducer MW-52S	August
Change Select Transducer Batteries	October, November

Table 7-1: Soil Cap O&M Activities Planned through 2021
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
Visual Inspections:	
Cap surface	Quarterly
Subsidence near EW-1s	Quarterly
Stormwater conveyance system	Quarterly
Security fencing	Quarterly
Warning signs	Quarterly
Abundance and survival of vegetation	Quarterly
Routine Maintenance and Monitoring:	
Manual removal of invasive plant	Semiannually, if necessary
Targeted application of herbicides	Semiannually, if necessary
Non-Routine Maintenance:	
Repairs of fence	As needed
Replacement of warning signs	As needed
Repairs of gravel roads	As needed
Filling of potential animal burrow into the earthen cap	As needed
Remove sediments from manholes	As needed
Irrigation	As needed
Replanting unsuccessful trees and shrubs	As needed
Utilities Service:	
Water, electric, alarm, solid waste, toilet	Continuous

Table 7-2: Sediment Cap O&M Activities Planned through 2021
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
Visual Inspections (from shore):	
Warning buoys	Quarterly
Cap surface	Quarterly
Habitat quality	Annually
Routine Monitoring:	
Water column and inter-armoring water sampling	Every 5 years (starting in 2015)
Organoclay Core Sampling	In 2015, then determine frequency
Non-Routine Monitoring:	
Multibeam bathymetric surveys, side-scan sonar survey	Every 10 years, starting in 2020; perform as needed (unforeseen natural event)
Diver Inspection	If necessary, will be conducted every 10 years starting in 2020, after bathymetry
Non-Routine Maintenance:	
Replacement of buoys	As needed
Additional armoring placement	Schedule for 2020, if needed. After unforeseen event, if needed
Additional organoclay capping	As needed
ACB grouting or armoring void space maintenance (habitat gravel)	Every 5 years , or as needed based on site inspections

Table 7-3: Groundwater O&M Activities Planned through 2021
2017 O&M Annual Report
McCormick and Baxter Superfund Site

O&M Activity	Frequency
NAPL Monitoring:	
Manual gauging of site wells	Semiannually
Manual extraction from exterior wells	Not recommended
Groundwater Monitoring:	
Downloading continuous water level data from transducers	Semiannually
Manual water level measurements from site wells	Semiannually
Groundwater Sampling:	
Site-wide	2020, Subsequent frequency to be determined
Infiltration pond (MW-59s)	Every 5 years
Routine Maintenance of Equipment:	
Interface probes, pumps, vehicle, data loggers / transducers, etc.	As needed

(b)(4) copyright

0 4,000 8,000

Scale in Feet

N

McCormick and Baxter Superfund Site
6900 N Edgewater Street, Portland, Oregon

Site Location Map

7/15

HARTCROWSER

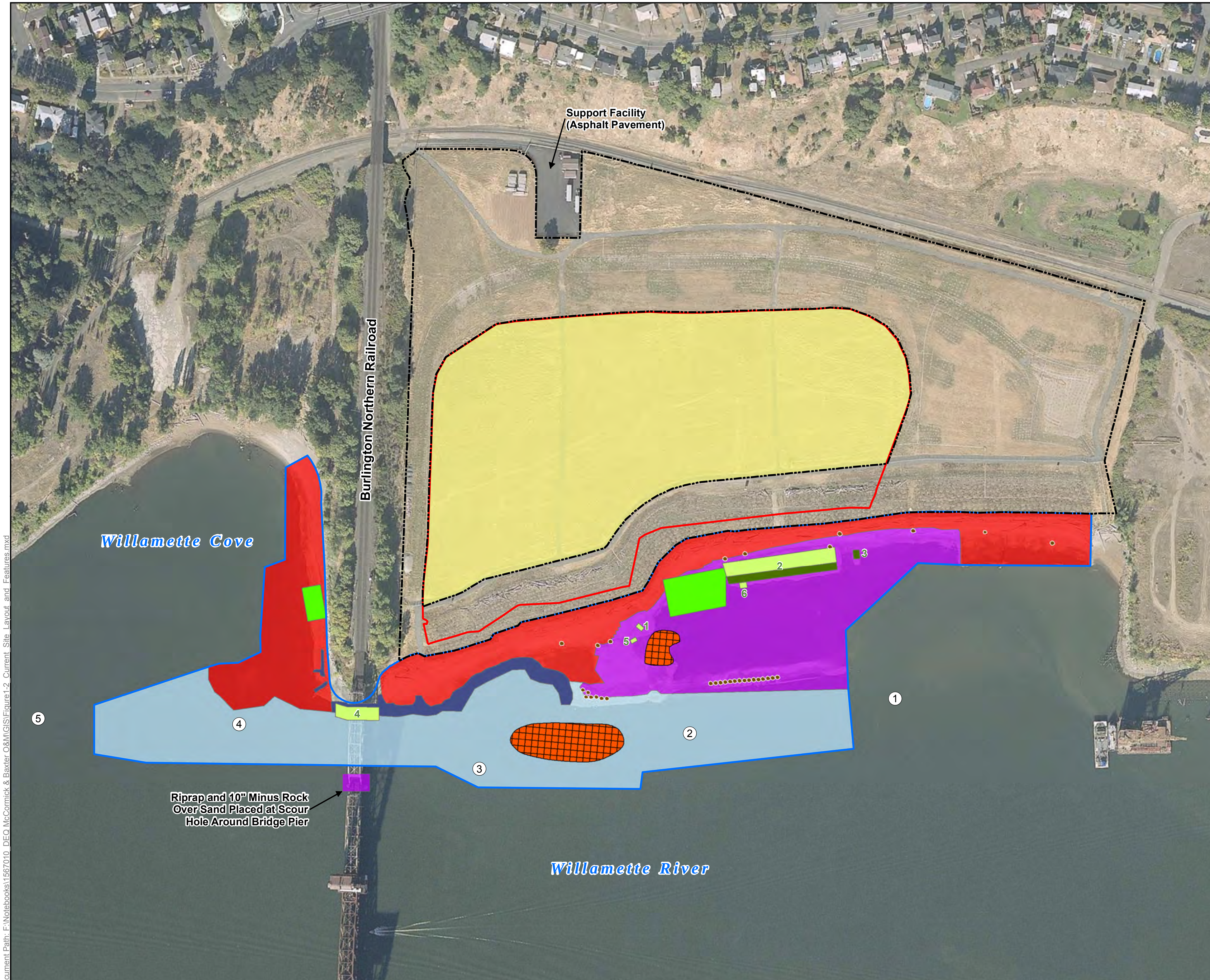
GSI Water Solutions, Inc.

Figure

1-1

Source: DeLorme Topo USA.

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\



LEGEND

- Subsurface Barrier Wall
- Sediment Cap Boundary
- Granular Organophilic Clay
- Organoclay™ Reactive Core Mats (Double)
- Organoclay™ Reactive Core Mats (Single)
- Thickened Sand Layer
- Boulder Clusters
- Buoy Locations
- Riprap Armor
- Articulated Concrete Block
- 6-inch Minus Rock Armor
- 10-inch Minus Rock Armor
- Impermeable Cap
- Earthen Soil Cap Boundary

NOTE:
Aerial photo taken on September 22, 2006.

0 250 500
Scale in feet

McCormick & Baxter Superfund Site
Portland, Oregon

Current Site Layout and Features

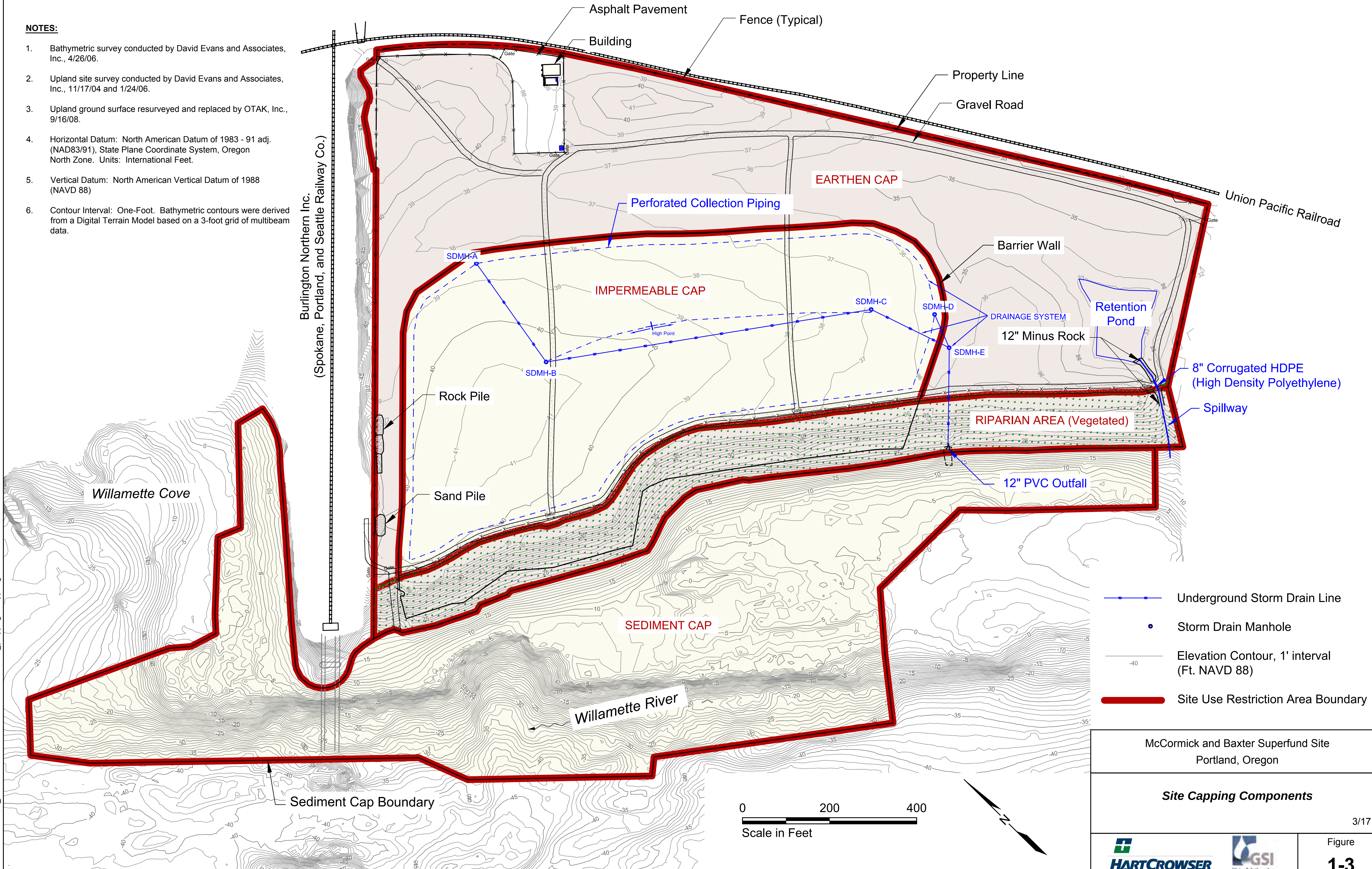
3/17

HARTCROWSER GSI Water Solutions, Inc.

Figure
1-2

NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc., 4/26/06.
2. Upland site survey conducted by David Evans and Associates, Inc., 11/17/04 and 1/24/06.
3. Upland ground surface resurveyed and replaced by OTAK, Inc., 9/16/08.
4. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System, Oregon North Zone. Units: International Feet.
5. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
6. Contour Interval: One-Foot. Bathymetric contours were derived from a Digital Terrain Model based on a 3-foot grid of multibeam data.



McCormick and Baxter Superfund Site
Portland, Oregon

Site Capping Components

3/17

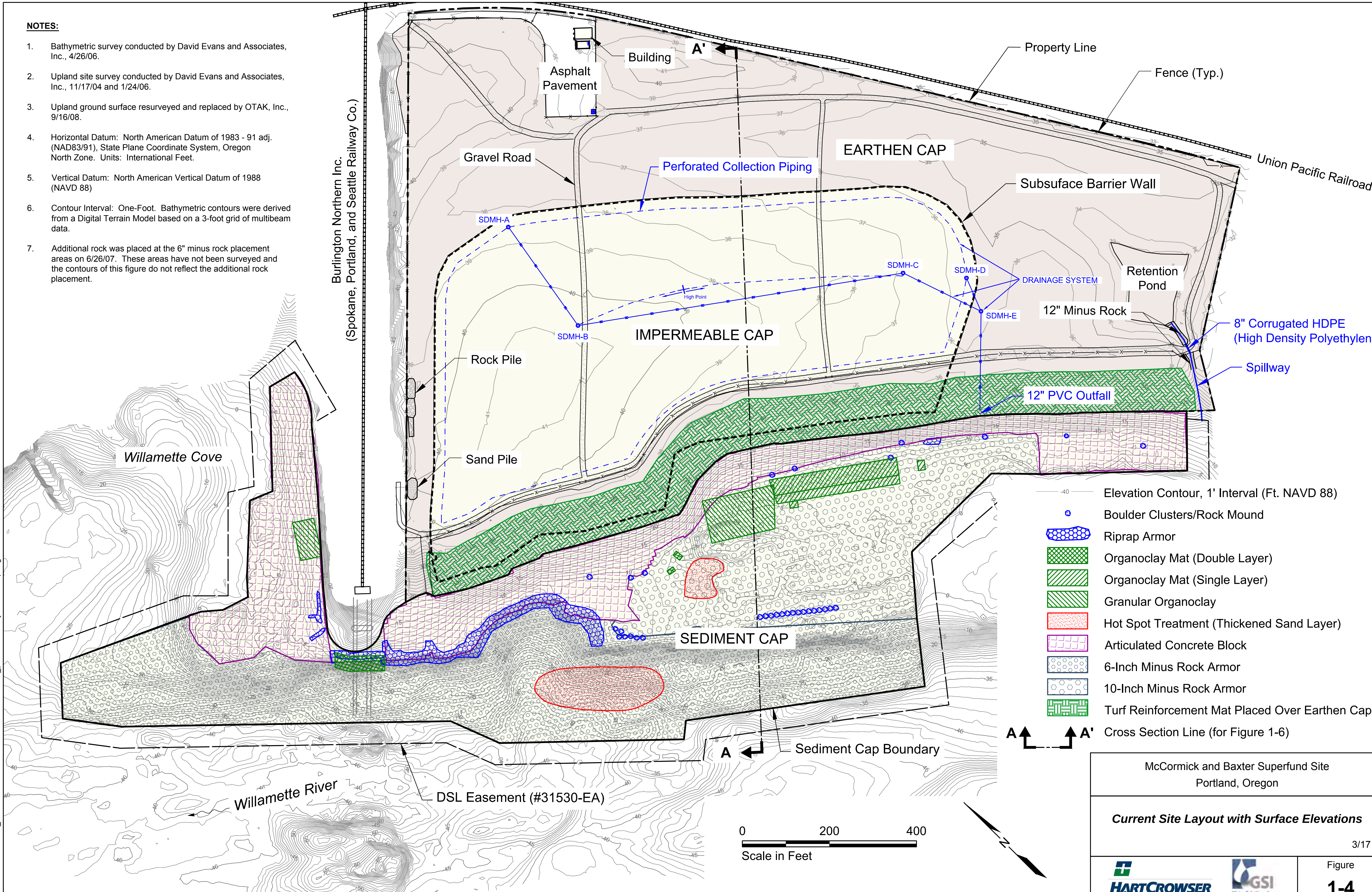
HARTCROWSER GSI Water Solutions, Inc.

Figure 1-3

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Capping Comp).dwg

NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc., 4/26/06.
2. Upland site survey conducted by David Evans and Associates, Inc., 11/17/04 and 1/24/06.
3. Upland ground surface resurveyed and replaced by OTAK, Inc., 9/16/08.
4. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System, Oregon North Zone. Units: International Feet.
5. Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)
6. Contour Interval: One-Foot. Bathymetric contours were derived from a Digital Terrain Model based on a 3-foot grid of multibeam data.
7. Additional rock was placed at the 6" minus rock placement areas on 6/26/07. These areas have not been surveyed and the contours of this figure do not reflect the additional rock placement.



McCormick and Baxter Superfund Site
Portland, Oregon

Current Site Layout with Surface Elevations

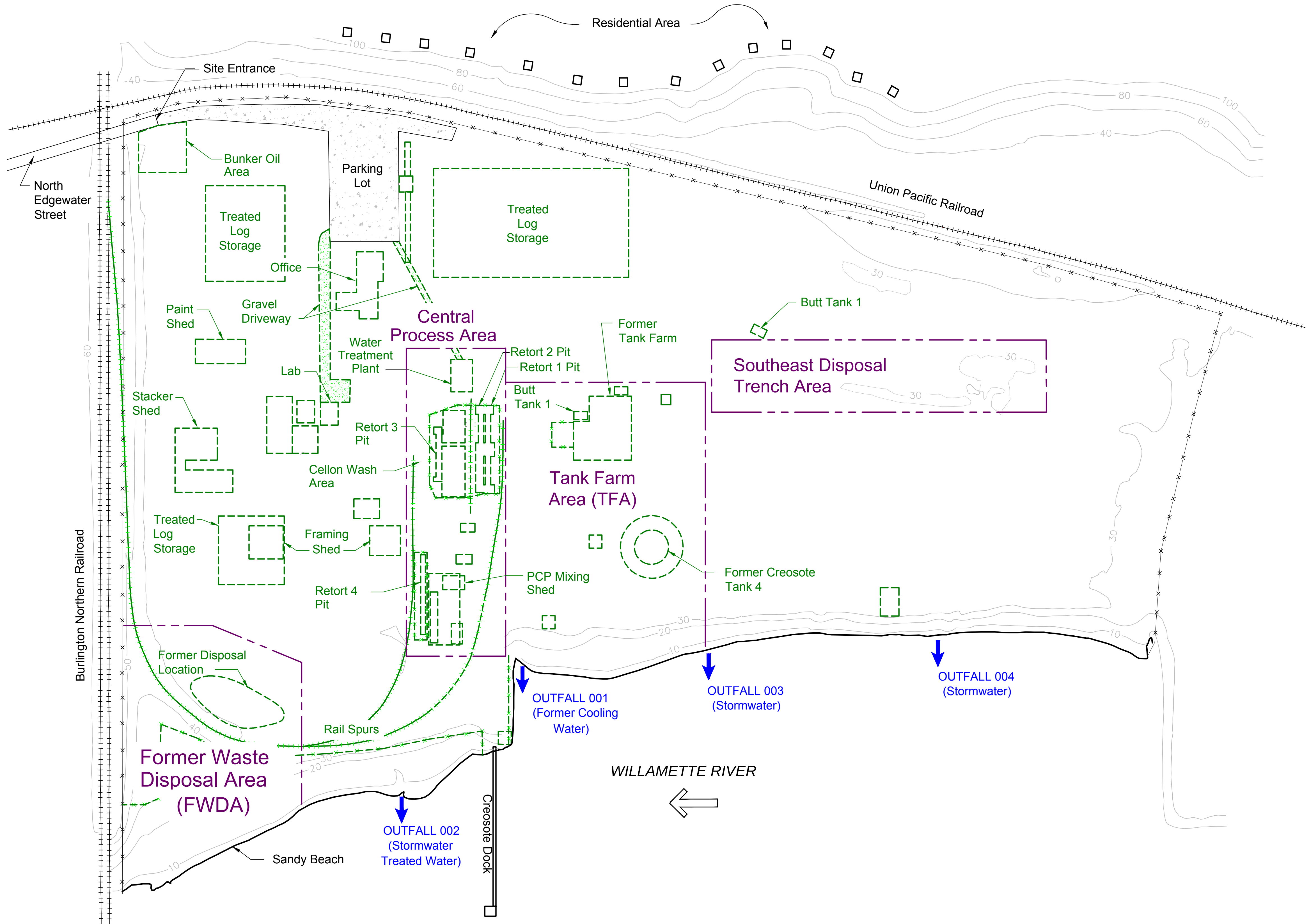
3/17

HARTCROWSER

GSI Water Solutions, Inc.

Figure **1-4**

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Current Site Layout-surfelev).dwg



McCormick and Baxter Superfund Site
Portland, Oregon

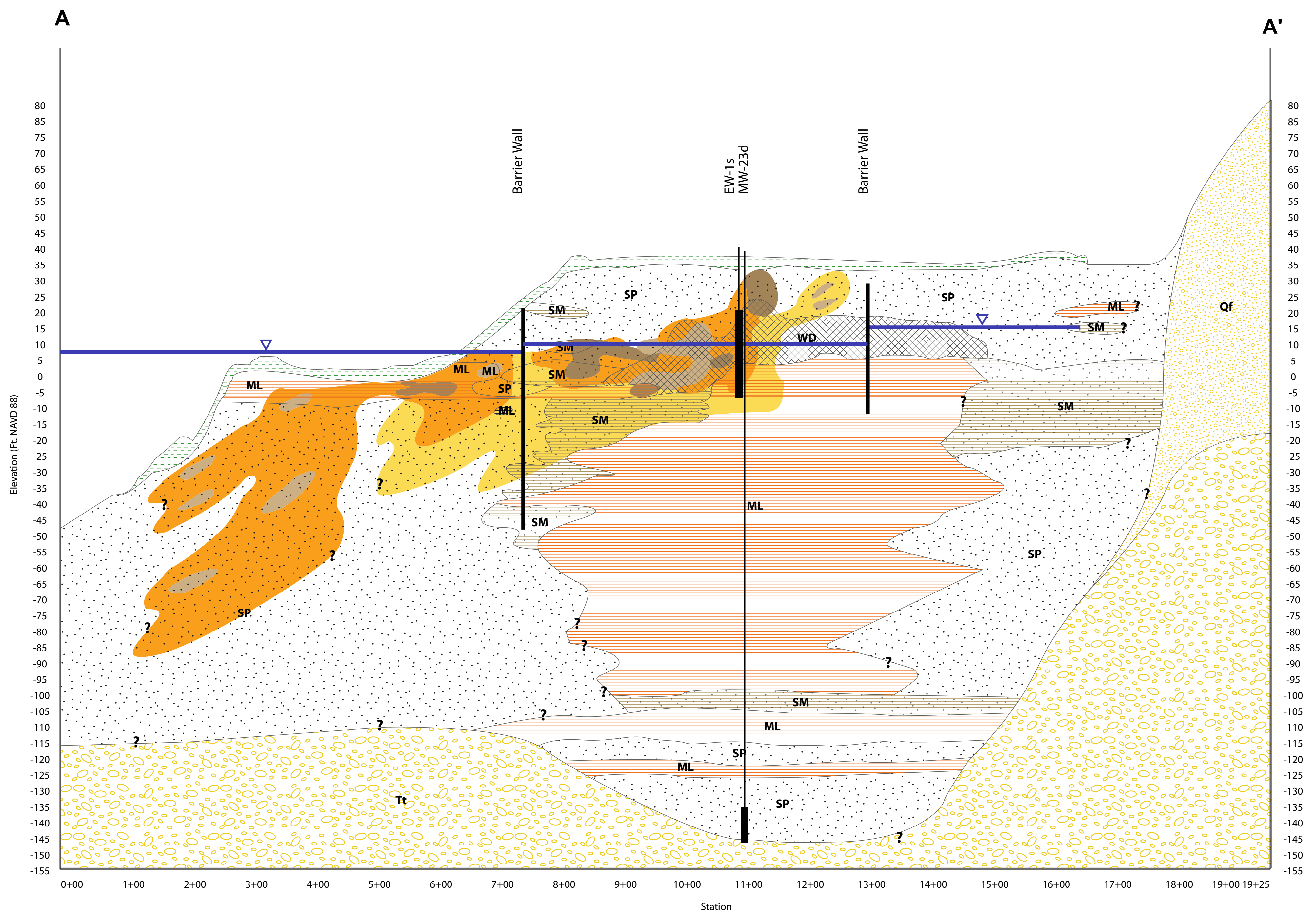
Historical Contaminant Source Areas

3/17

HARTCROWSER GSI Water Solutions, Inc.

Figure **1-5**

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Historic Contamination).dwg



LEGEND

- SP- Sand, Fine to Medium, Poorly Graded
- SM- Silt Sand, or Thin Interbeds of Silt and Sand
- ML- Clayey Silt or Silty Clay
- WD- Wood Debris, Chips or Sawdust Occasionally
- Qf- Catastrophic Flood Deposits Consisteing of Gravels and Sands
- Tt- Troutdale Formation
- Sediment/Soil Cap
- Approximate Average Water Level 2008
- Creosote Odor
- Strong Creosote Odor
- Heavy Sheen
- Saturated

NOTE: Refer to Figure 1-4 for Plan View of Cross Section Location.

Horizontal Scale in Feet

0 200 400

0 40 80

Vertical Scale in Feet

Vertical Exaggeration = 5x

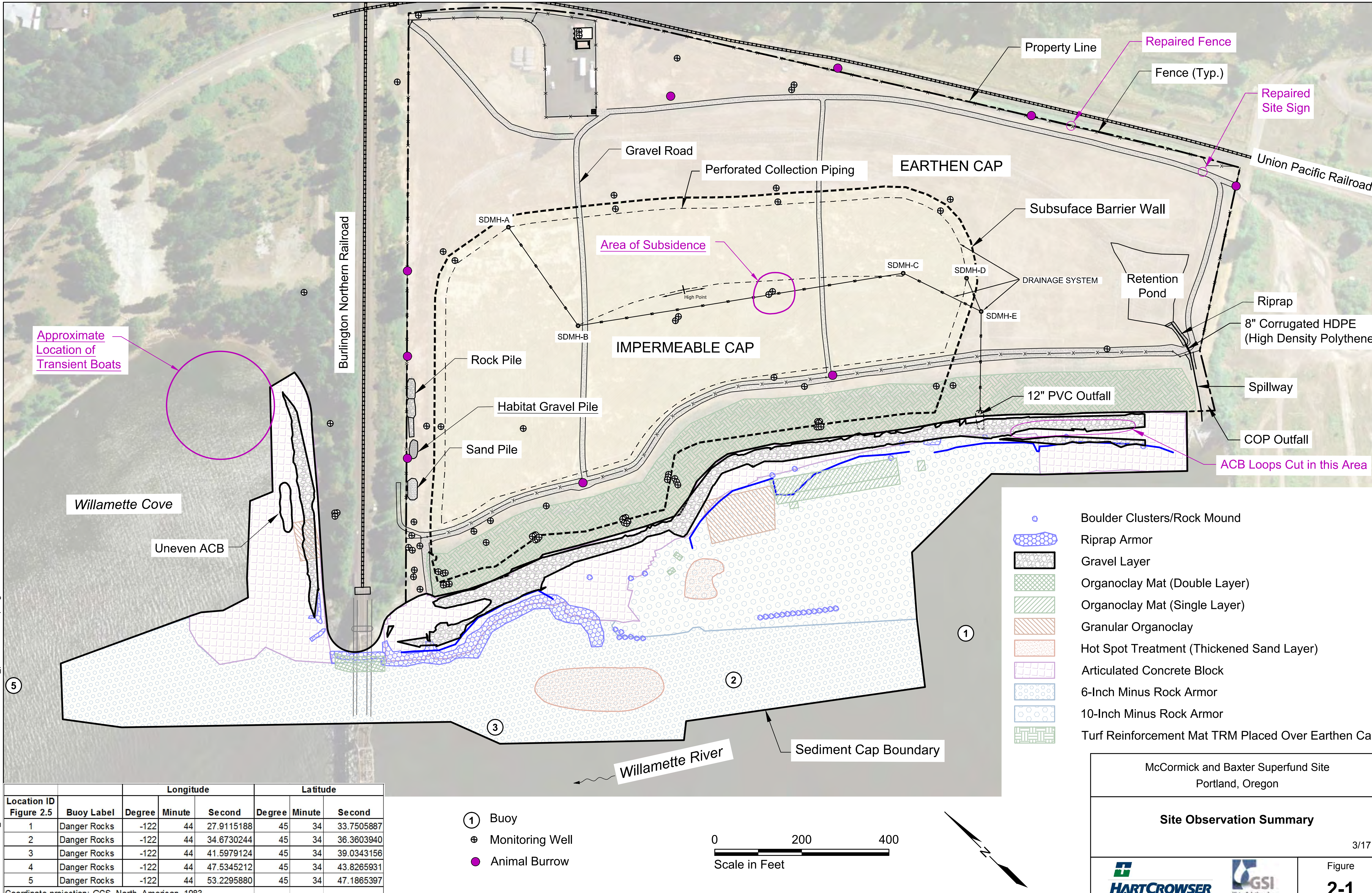
McCormick and Baxter Superfund Site
Portland, Oregon

Historical NAPL Distribution Cross Section

3/17

HARTCROWSER GSI Water Solutions, Inc.

Figure
1-6



		Longitude			Latitude		
Location ID Figure 2.5	Buoy Label	Degree	Minute	Second	Degree	Minute	Second
1	Danger Rocks	-122	44	27.9115188	45	34	33.7505887
2	Danger Rocks	-122	44	34.6730244	45	34	36.3603940
3	Danger Rocks	-122	44	41.5979124	45	34	39.0343156
4	Danger Rocks	-122	44	47.5345212	45	34	43.8265931
5	Danger Rocks	-122	44	53.2295880	45	34	47.1865397
Coordinate projection: GCS_North_American_1983							

McCormick and Baxter Superfund Site
Portland, Oregon

Site Observation Summary

3/17

HARTCROWSER

GSI Water Solutions, Inc.

Figure
2-1

F:\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Site Observation).dwg

LEGEND

- Groundwater Monitoring Wells
- Groundwater Monitoring Wells with Transducers
- Subsurface Barrier Wall

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

12/15

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-1

Document Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project GIS\Project_mxds\2015 Annual Report\Figure4-1_Monitoring_Well_Location_Map.mxd

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Monitoring Wells with Transducers (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (13.7 feet)
- Subsurface Barrier Wall

NOTES:
1) Elevations shown in NAVD 88.
2) Aerial photo taken on September 22, 2006.
3) Water levels measured between 8:10 and 12:15.
4) Willamette River low tide at 13:30 at 13.7 feet NAVD88.
5) Unable to access MW-7 WC.

0 200 400
Scale in feet

N

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for June 21, 2017 Sampling Event

7/17

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-2

Document Path: P:\Portland\205 - OR DEQ\003-003 M&B\Project_GIS\Project_mxds\2017_Annual_Report\Figure4-2_GW_Elevations_June2017.mxd

LEGEND

- Groundwater Monitoring Wells (Groundwater Elevation)
- Groundwater Monitoring Wells with Transducers (Groundwater Elevation)
- Groundwater Elevation Contours (dashed where inferred)
- Willamette River Level During Sampling Event (6.4 feet)
- Subsurface Barrier Wall

NOTES:
1) Elevations shown in NAVD 88.
2) Aerial photo taken on September 22, 2006.
3) Water levels measured between 8:40 and 11:40.
4) Willamette River low tide at 13:00 at 6.4 feet NAVD88.

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Contour Map for September 17, 2017 Sampling Event

7/17

HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-3

Document Path: P:\Portland\205 - OR DEQ\003-003 M&B\Project_mxds\2017_Annual_Report\Figure4-3_GW_Elevations_Sept2017.mxd

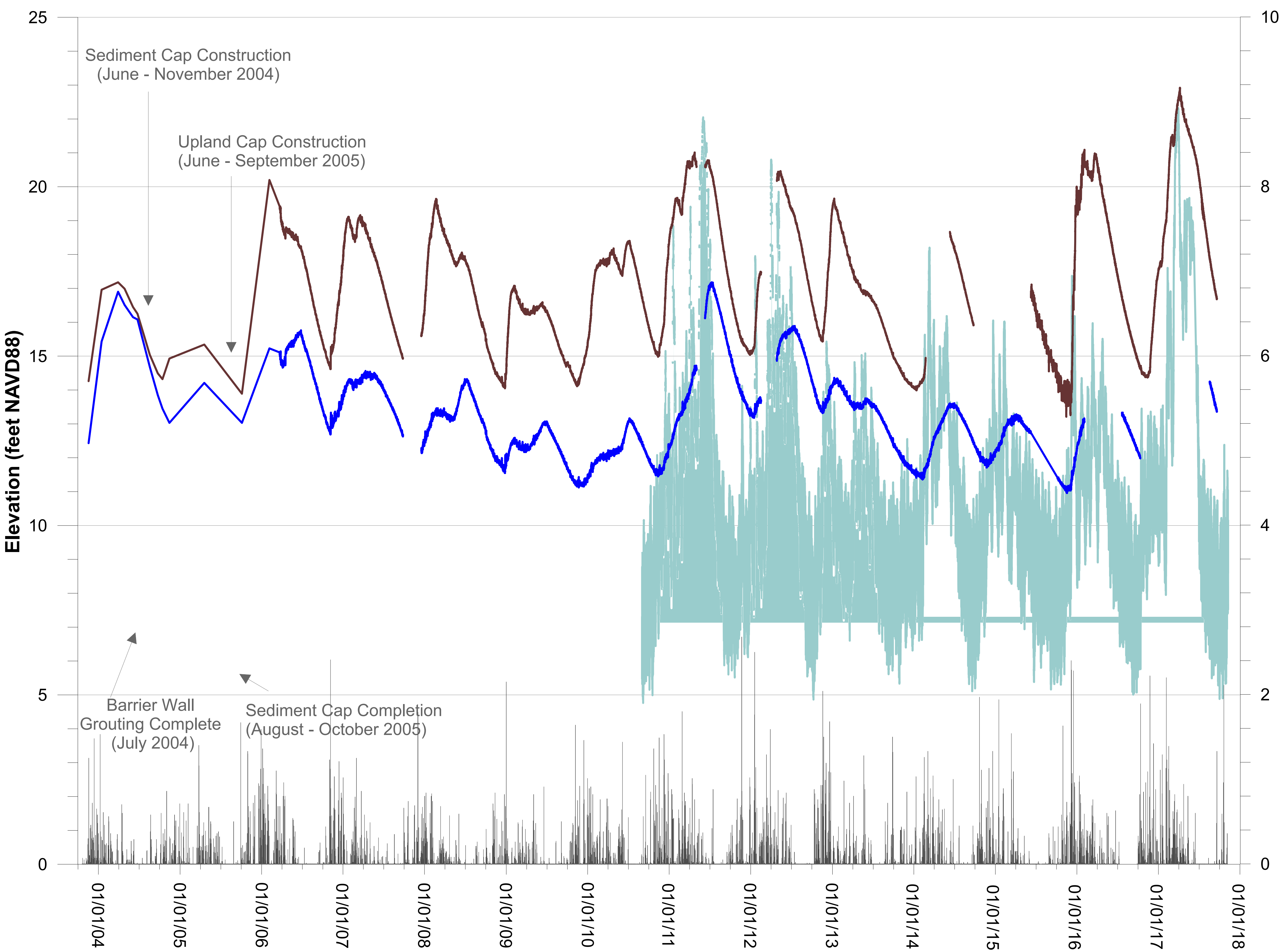


Figure 4-4:
Post-Barrier Wall Groundwater Elevations
Monitoring Wells MW-52s and MW-53s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-52s (Interior)
- MW-53s (Exterior)
- River
- Precipitation

Notes:
MW-52s is located inside the barrier wall and MW-53s is located outside the barrier wall.

Top of Barrier wall (not shown) is about 31 ft NAVD.

Prior to March 23, 2006 water level measurements are manual and intermittent.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

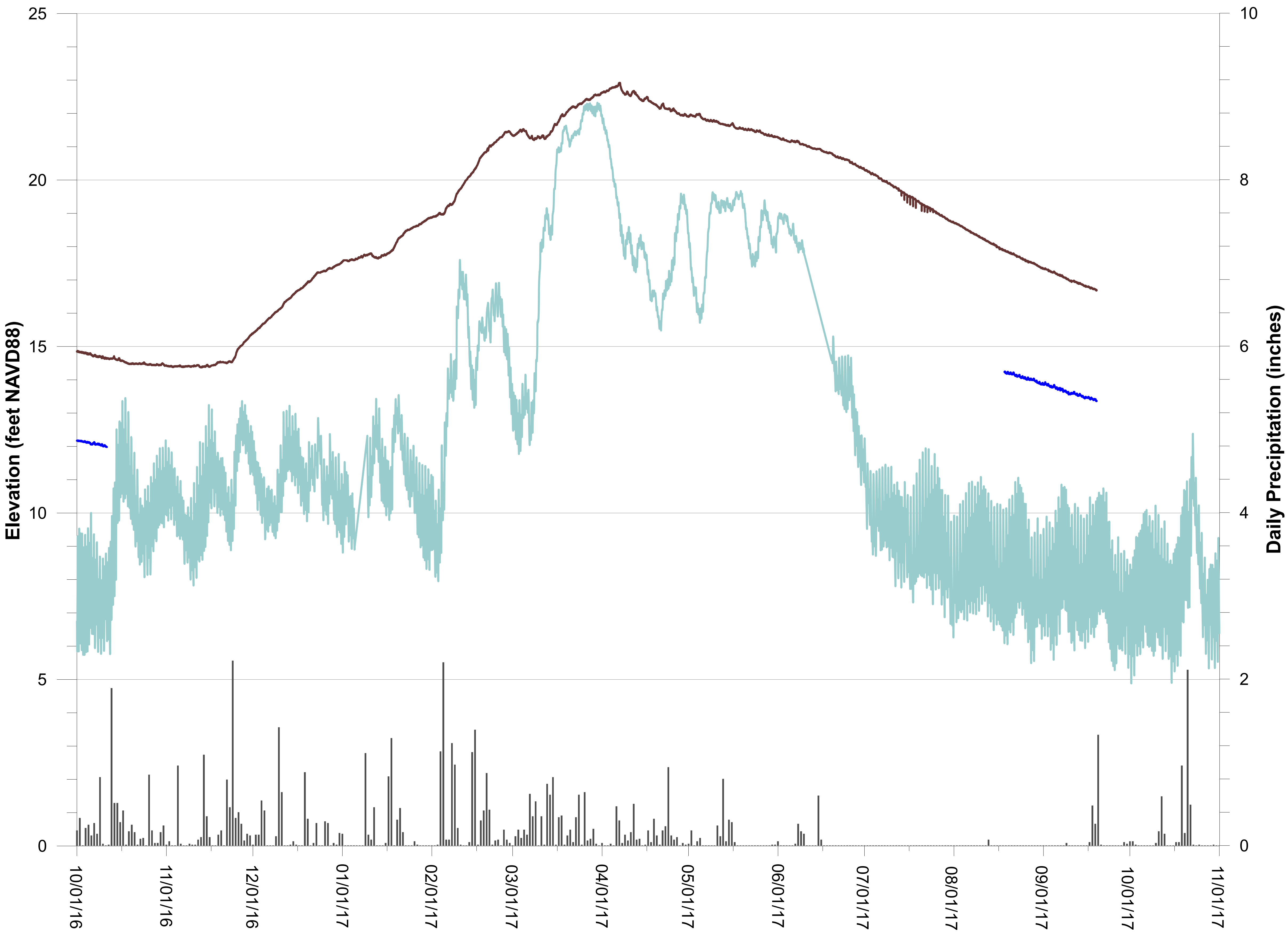


Figure 4-5:
2017 Groundwater Elevations
Monitoring Wells MW-52s and MW-53s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

MW-52s (Interior)
MW-53s (Exterior)
River
Precipitation

Notes:
MW-52s is located inside the barrier wall and MW-53s is located outside the barrier wall.

Top of Barrier wall (not shown) is about 31 ft NAVD.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

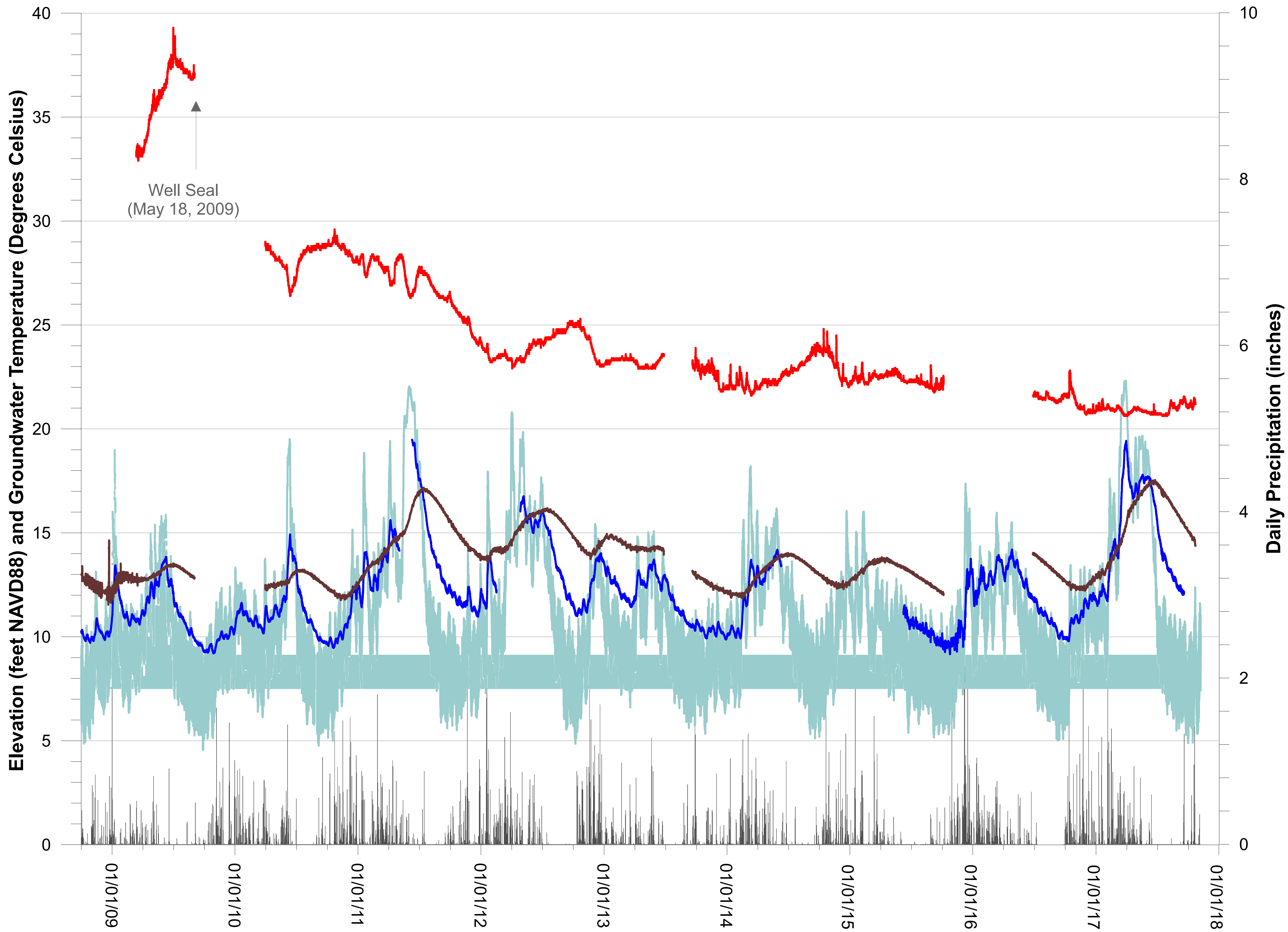


Figure 4-6:
2008 to 2017 Groundwater Temperature in Montoring Well EW-1s and Groundwater Elevations Monitoring Wells MW-36s and EW-1s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- EW-1s Temperature
- EW-1s Water Elevation
- MW-36s Water Elevation
- River Elevation
- Precipitation

Notes:
Monitoring wells EW-1s and MW-36s are located inside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

Groundwater elevation manually adjusted 0.25 ft up between 17:00 on May 6, 2010 and 14:00 on June 15, 2010 due to apparent displacement from field activities.

HARTCROWSER

GSI Water Solutions, Inc.

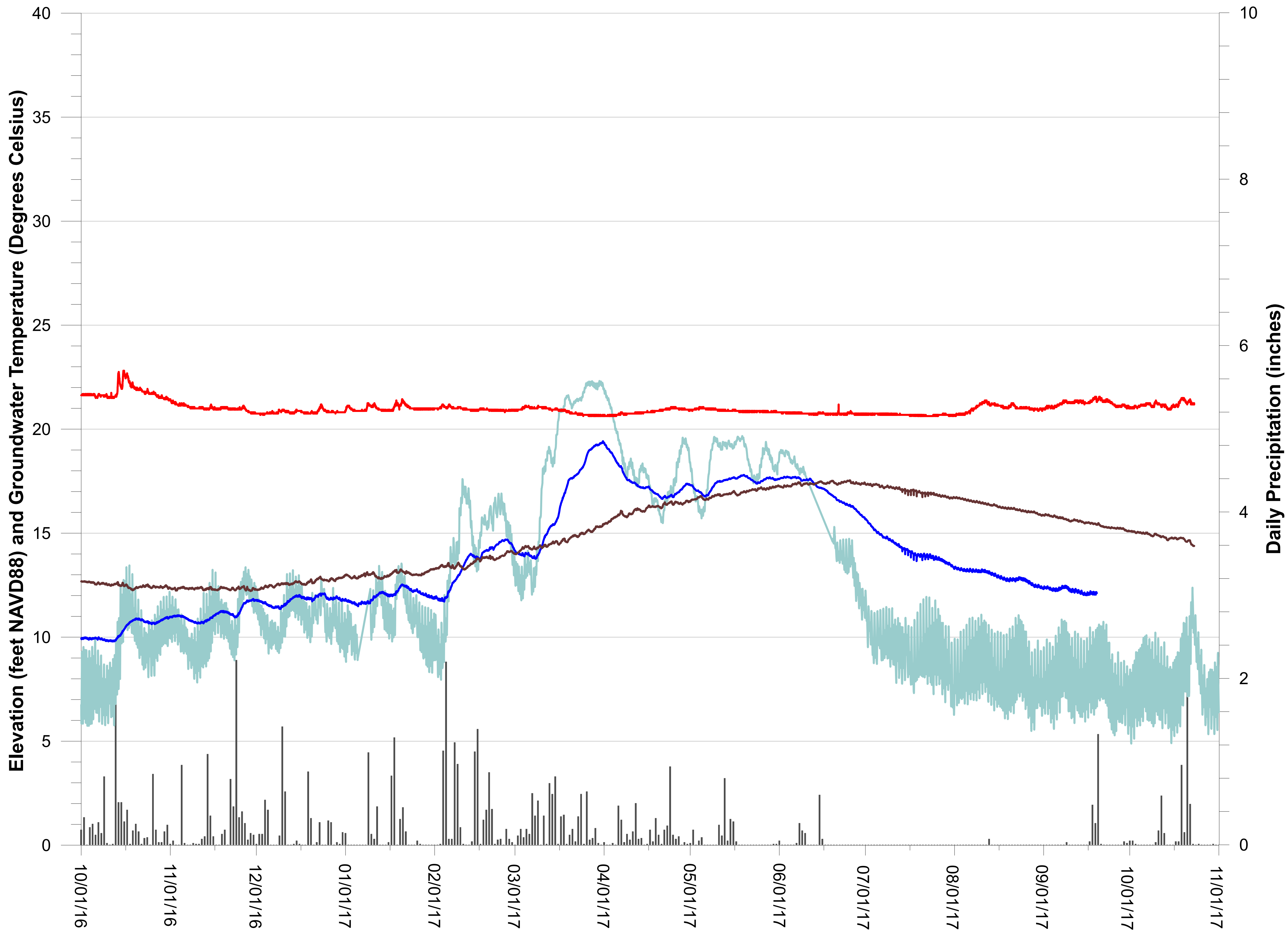


Figure 4-7:
2017 Groundwater Temperature in Montoring Well EW-1s and Groundwater Elevations Monitoring Wells MW-36s and EW-1s

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- EW-1s Temperature
- EW-1s (Interior)
- MW-36s (Interior)
- River
- Precipitation

Notes:
Monitoring wells EW-1s and MW-36s are located inside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

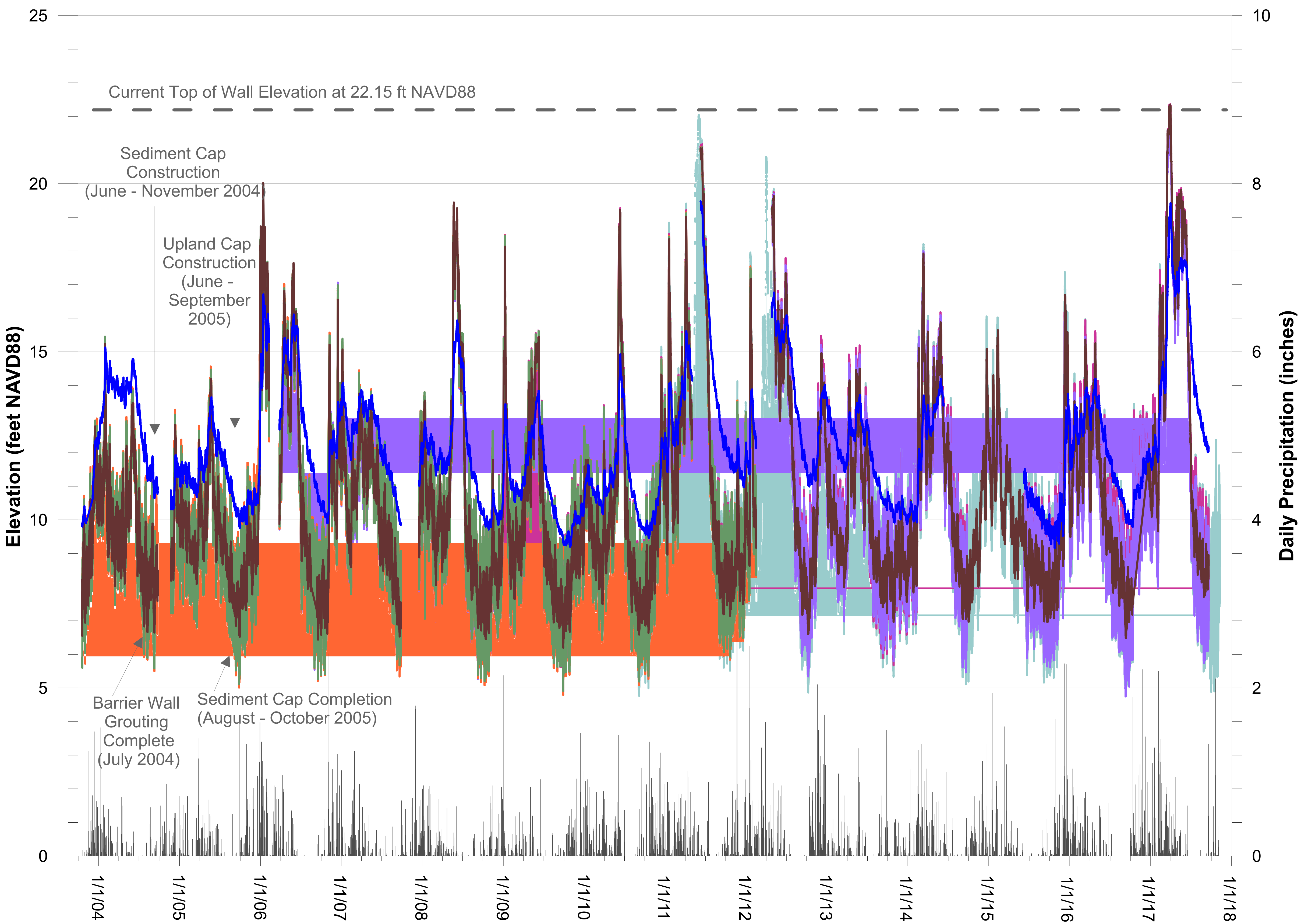


Figure 4-8:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-36 and MW-37

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-36s (Interior)
- MW-36i (Interior)
- MW-36d (Interior)
- MW-37s (Exterior)
- MW-37i (Exterior)
- MW-37d (Exterior)
- River
- Precipitation

Notes:
MW-36 wells are located inside the barrier wall and MW-37 wells are located outside the barrier wall.

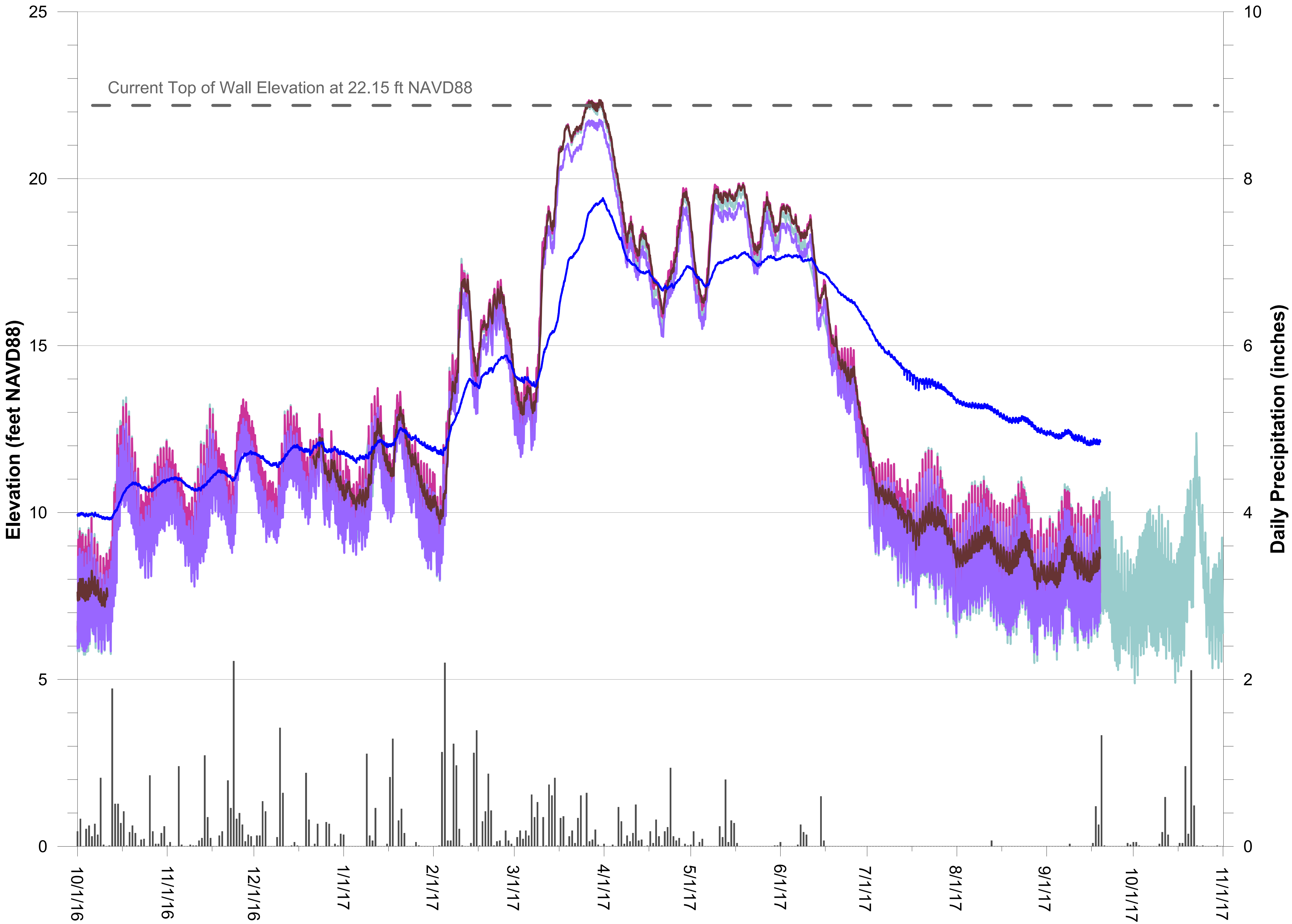
Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer that was not collecting accurate pressure readings. Transducers in MW-36i and MW-37i were removed on February 16, 2012.

HARTCROWSER

GSI Water Solutions, Inc.

Figure 4-9:
2017 Groundwater Elevations in Monitoring Wells MW-36 and MW-37

McCormick and Baxter Superfund Site
Portland, OR



LEGEND

- MW-36s (Interior)
- MW-36d (Interior)
- MW-37s (Exterior)
- MW-37d (Exterior)
- River
- Precipitation

Notes:
MW-36 wells are located inside the barrier wall and MW-37 wells are located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

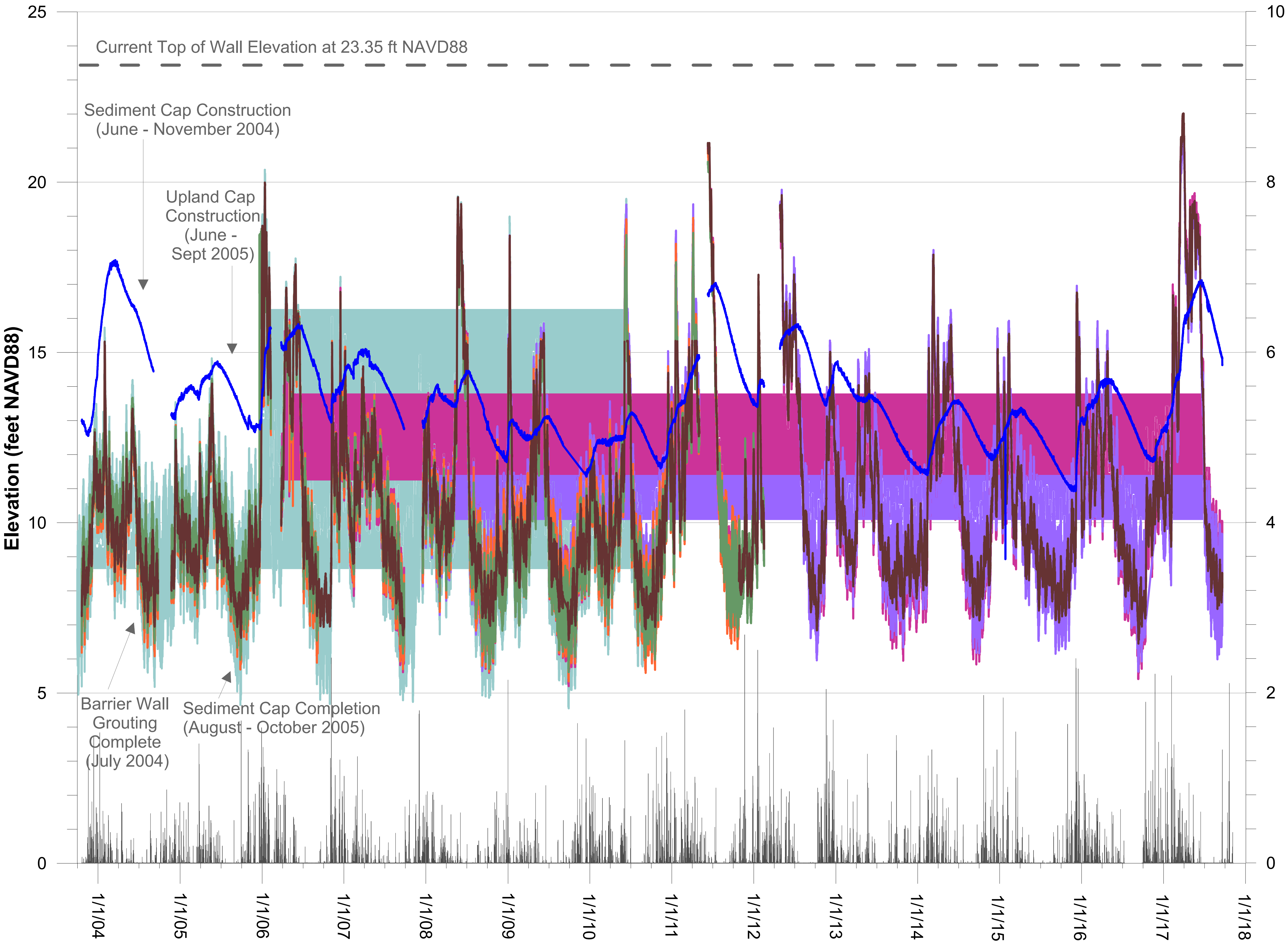


Figure 4-10:
Post-Barrier Wall Groundwater Elevations in Monitoring Wells MW-44 and MW-45

McCormick and Baxter Superfund Site
Portland, OR

LEGEND
- MW-44s (Interior)
- MW-44i (Interior)
- MW-44d (Interior)
- MW-45s (Exterior)
- MW-45i (Exterior)
- MW-45d (Exterior)
- River
- Precipitation

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings. Transducers were removed from MW-44i and MW-45i on February 16, 2012.

HARTCROWSER

GSI Water Solutions, Inc.

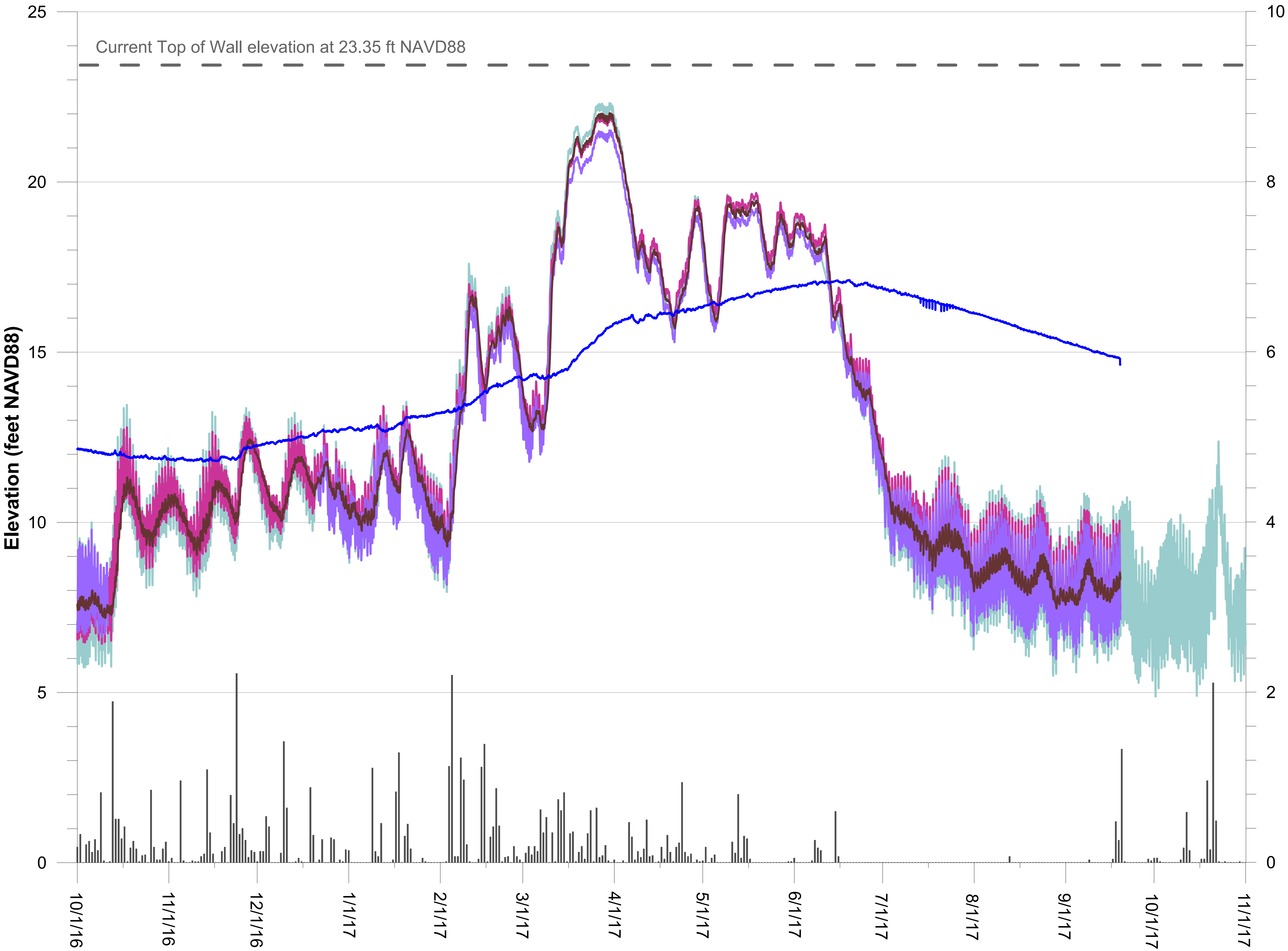


Figure 4-11:
2017 Groundwater Elevations
in Monitoring Wells MW-44 and MW-45

McCormick and Baxter Superfund Site
Portland, OR

LEGEND

- MW-44s (Interior)
- MW-44d (Interior)
- MW-45s (Exterior)
- MW-45d (Exterior)
- River
- Precipitation

Notes:
MW-44 well cluster is located inside the barrier wall and MW-45 well cluster is located outside the barrier wall.

Breaks in transducer data are the result of removal for calibration, removal for well modification, or a transducer was not collecting accurate pressure readings.

HARTCROWSER

GSI Water Solutions, Inc.

LEGEND

Groundwater Monitoring Wells (Thickness of LNAPL or DNAPL)

- Wells with LNAPL
- Wells with DNAPL
- Wells without LNAPL or DNAPL
- Subsurface Barrier Wall

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400

Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

LNAPL and DNAPL Distribution Map for June 21, 2017 Sampling Event

7/17

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-12

LEGEND

Groundwater Monitoring Wells (Thickness of LNAPL or DNAPL)

- Wells with LNAPL
- Wells with DNAPL
- Wells without LNAPL or DNAPL
- Subsurface Barrier Wall

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

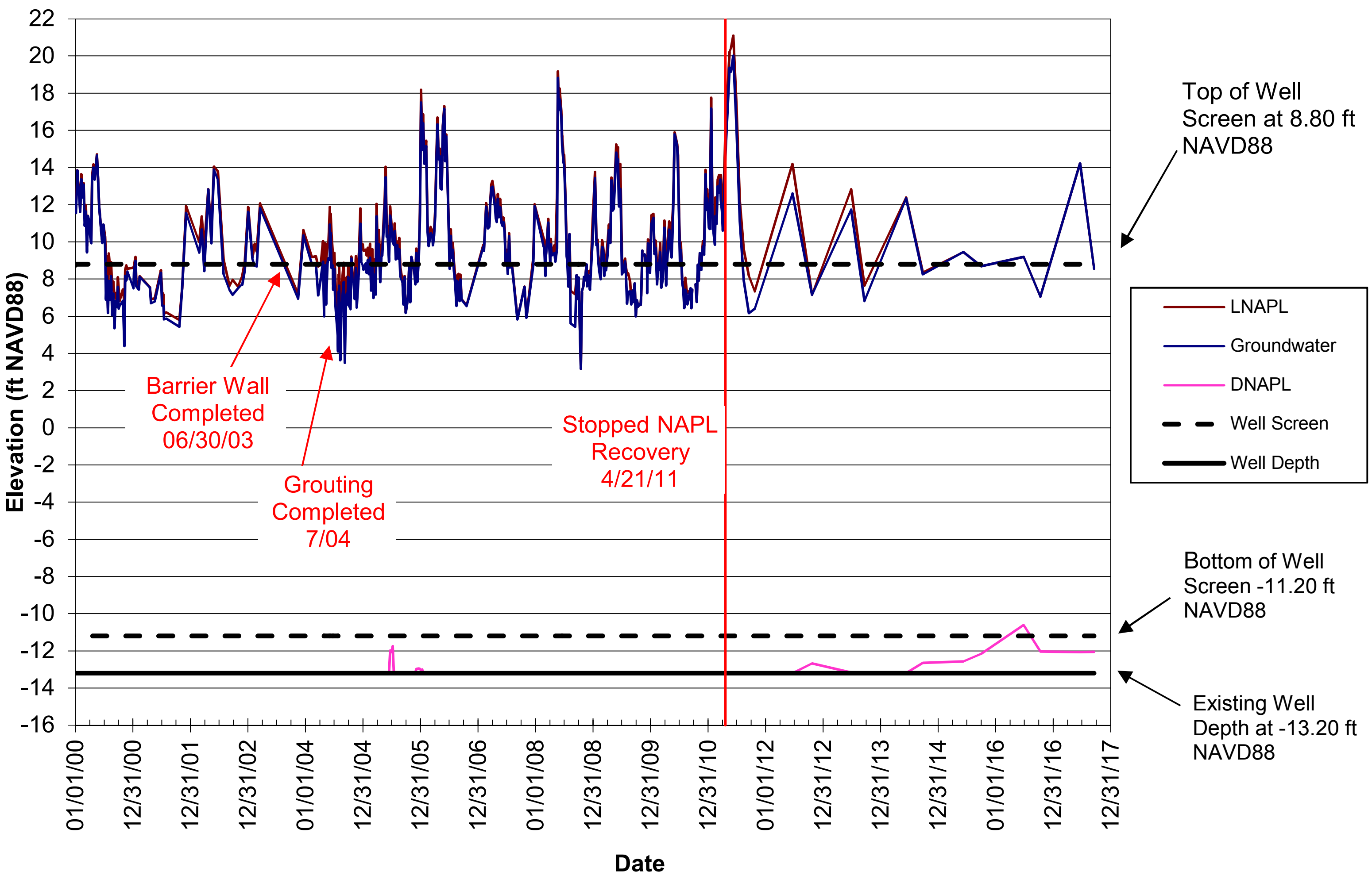
LNAPL and DNAPL Distribution Map for September 17, 2017 Sampling Event

7/17

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-13

Document Path: P:\Portland\205 - OR DEQ\003-003 M&B\Project_GIS\Project_mxds\2017_Annual_Report\Figure4-13_LNAPL_and_DNAPL_Map_Sept2017.mxd



HARTCROWSER

GSI Water Solutions, Inc.

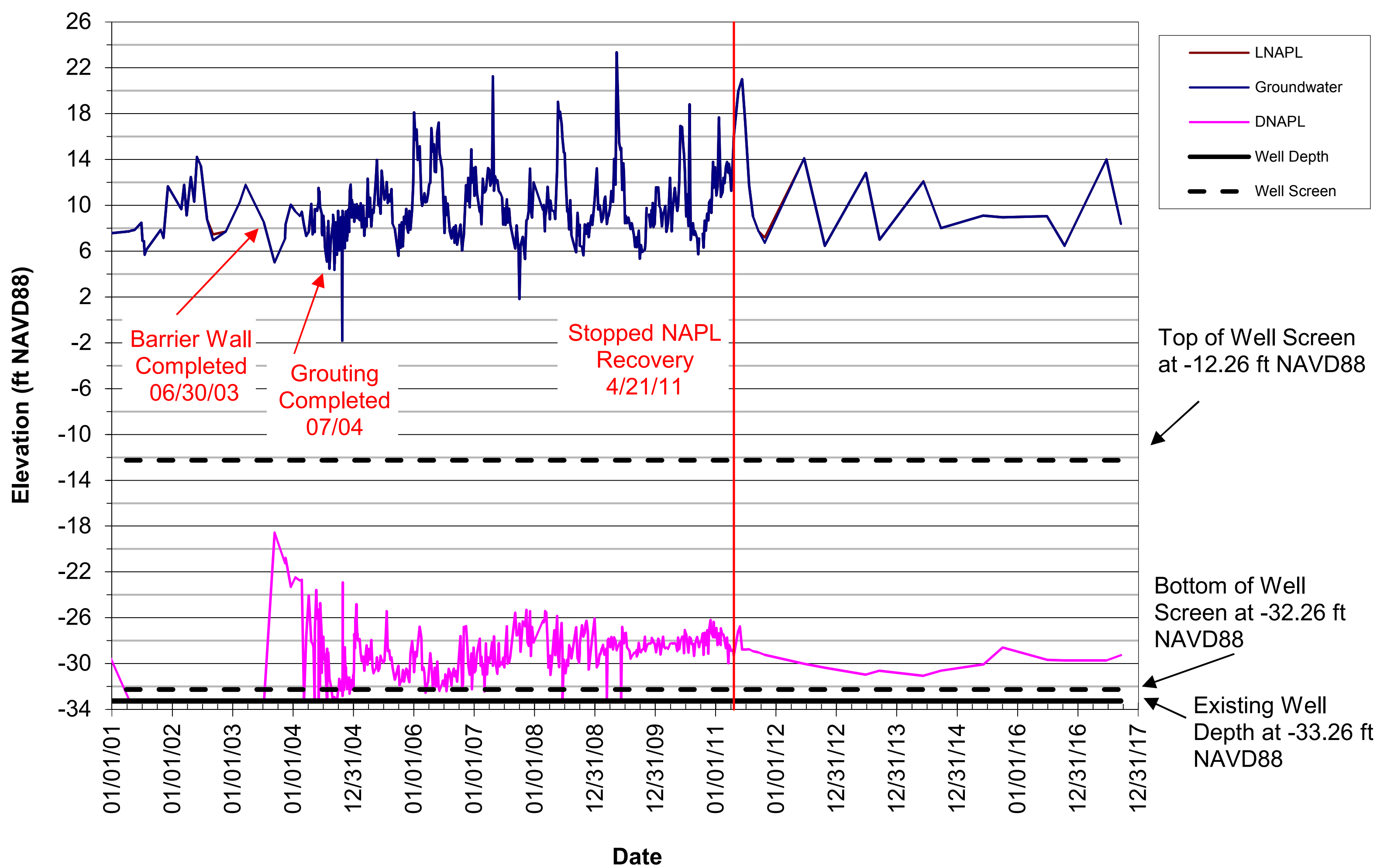
McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2017 NAPL Thickness Plot for Well EW-10s

11/2017

Figure

4-14



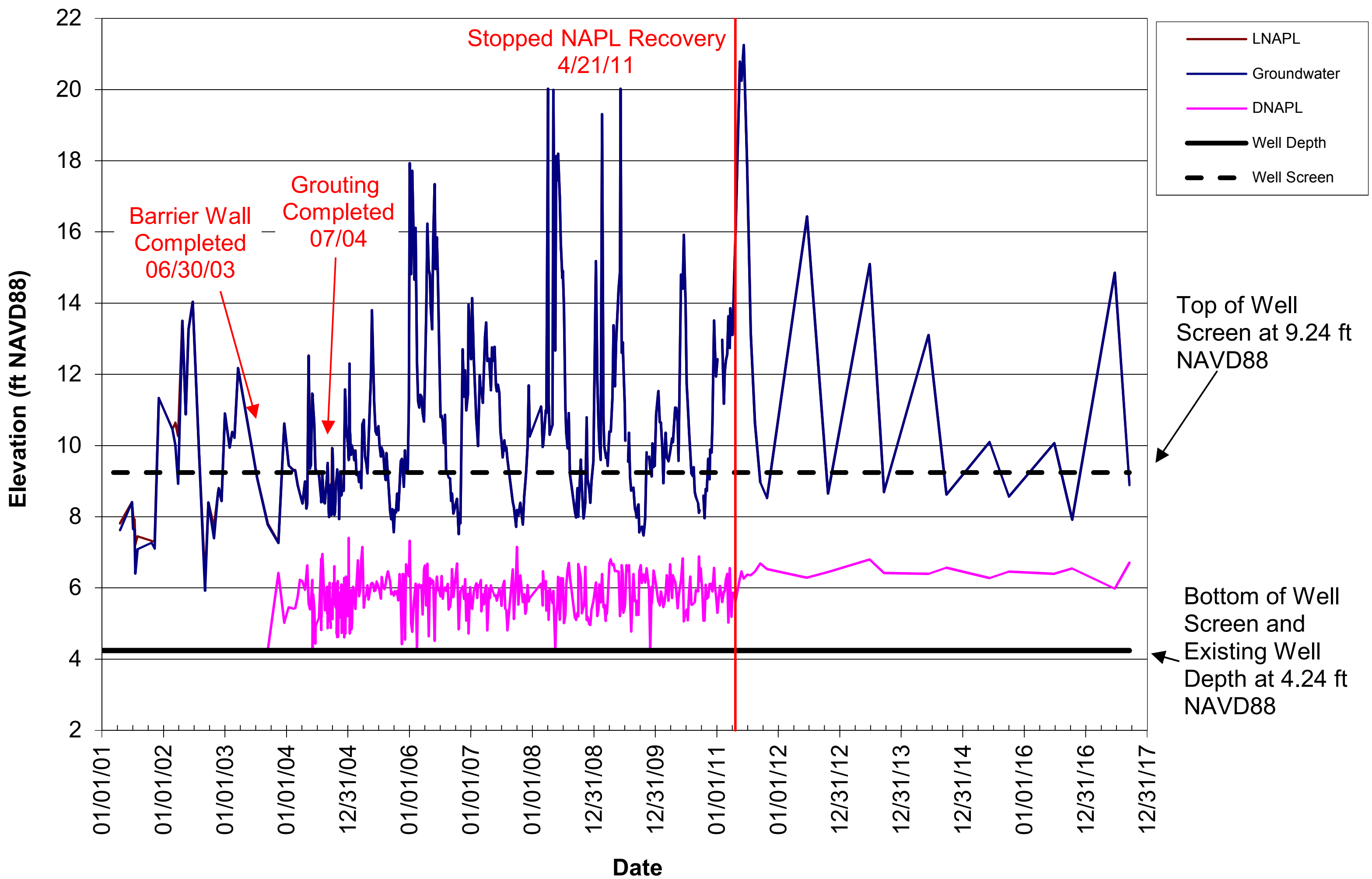
Note: DNAPL recovery was attempted in July 2007 but the extracted liquid appeared to be water with speck sized globules of DNAPL (with a creosote odor), rather than a distinct layer, suggesting that the DNAPL thicknesses measured may not accurately reflect the amount of DNAPL in the well.

McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2017 NAPL Thickness Plot for Well MW-20i

11/2017

Figure
4-15



McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2017 NAPL Thickness Plot for Well MW-Ds

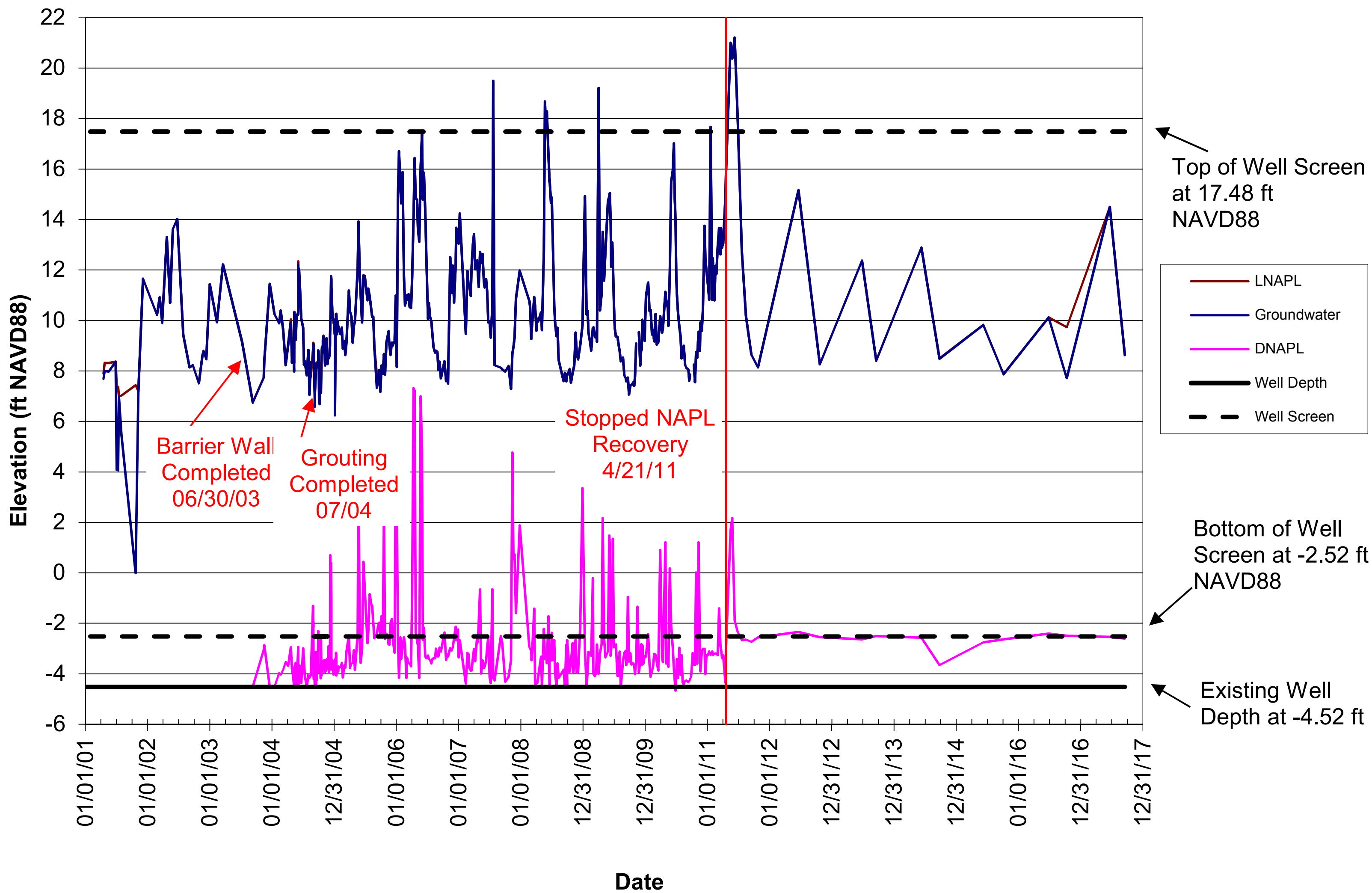
11/2017

HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-16



McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2017 NAPL Thickness Plot for Well MW-Gs

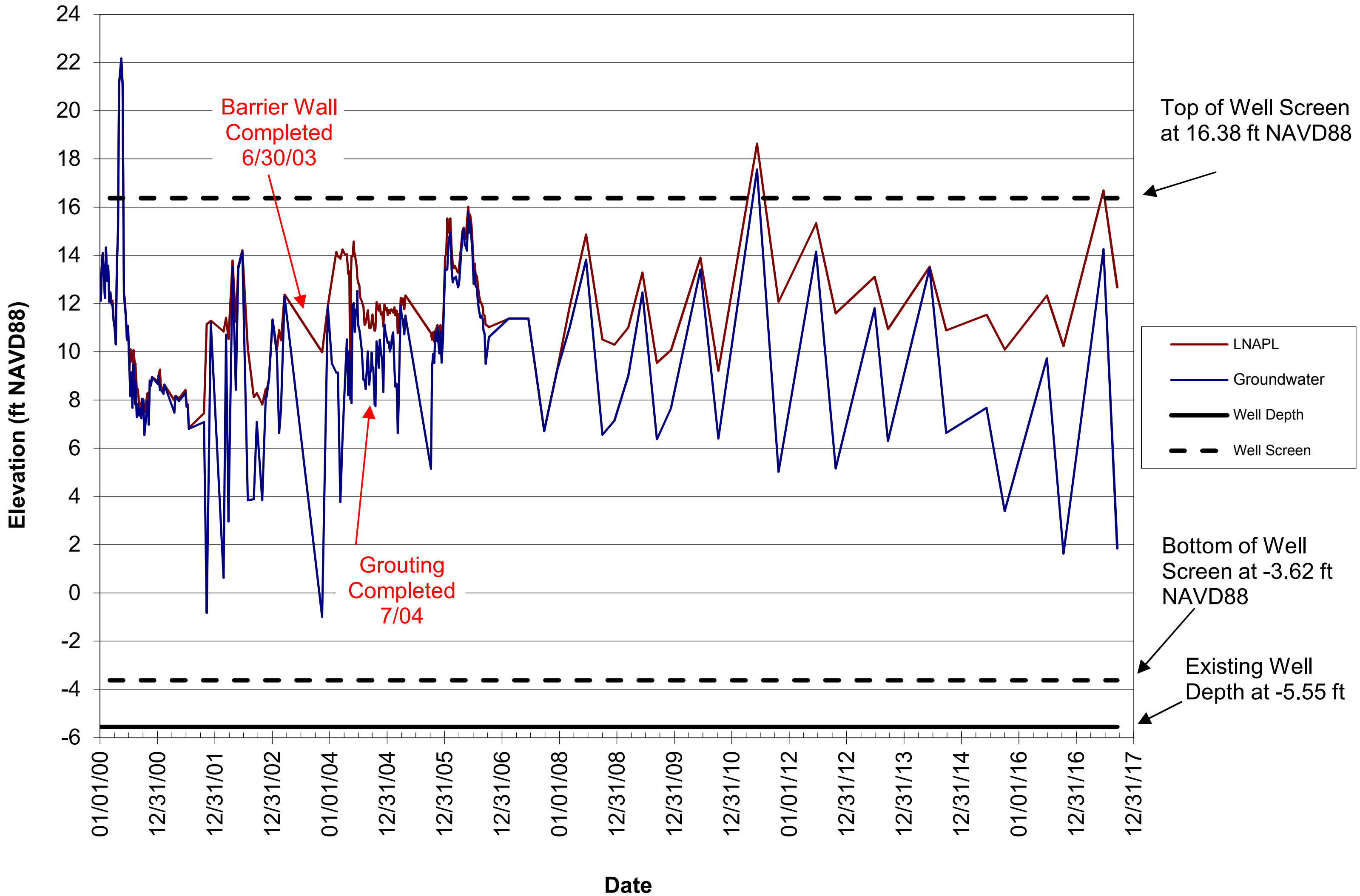
11/2017

HARTCROWSER

GSI Water Solutions, Inc.

Figure

4-17

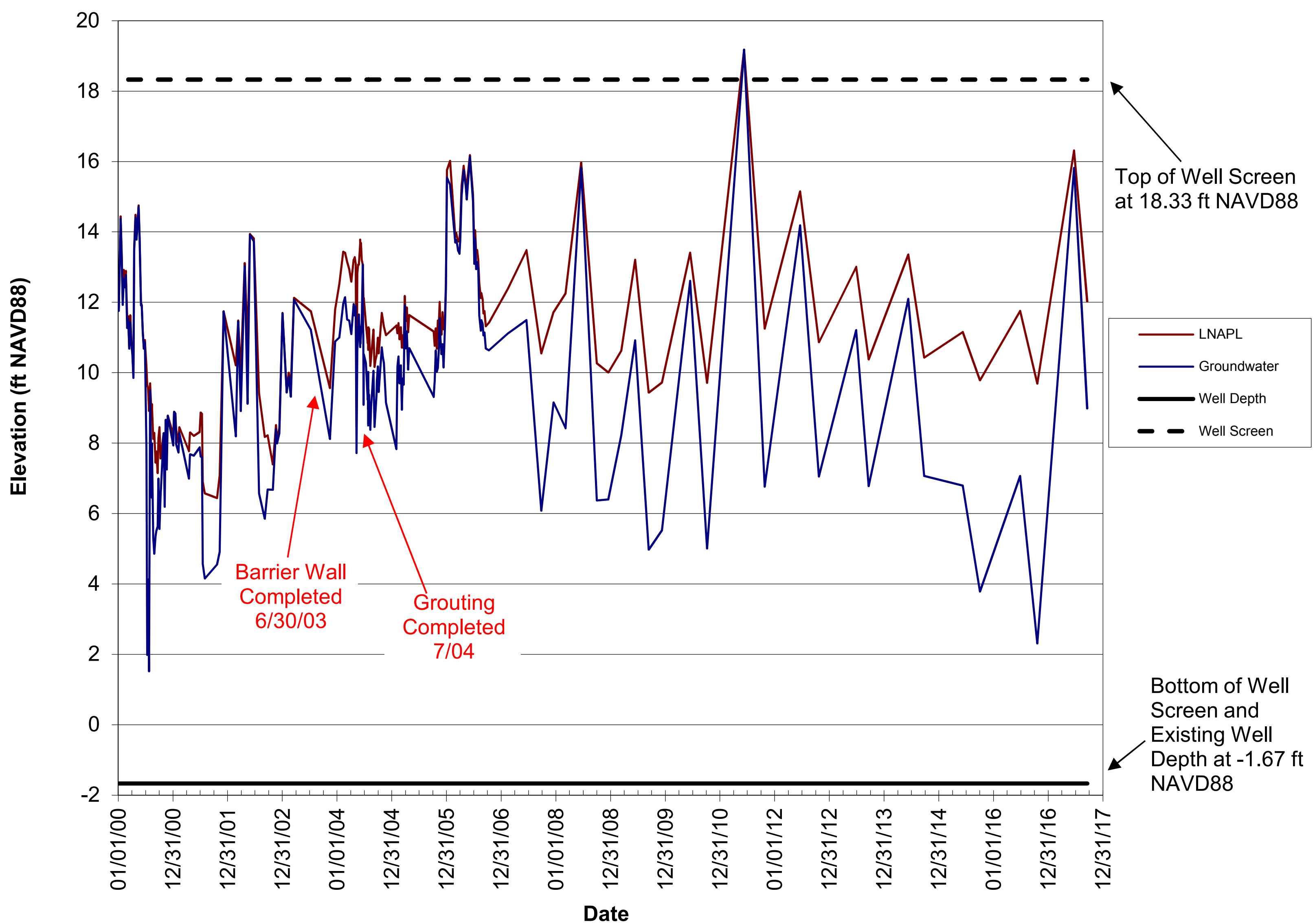


McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2017 NAPL Thickness Plot for Well EW-15s

11/2017

Figure
4-18



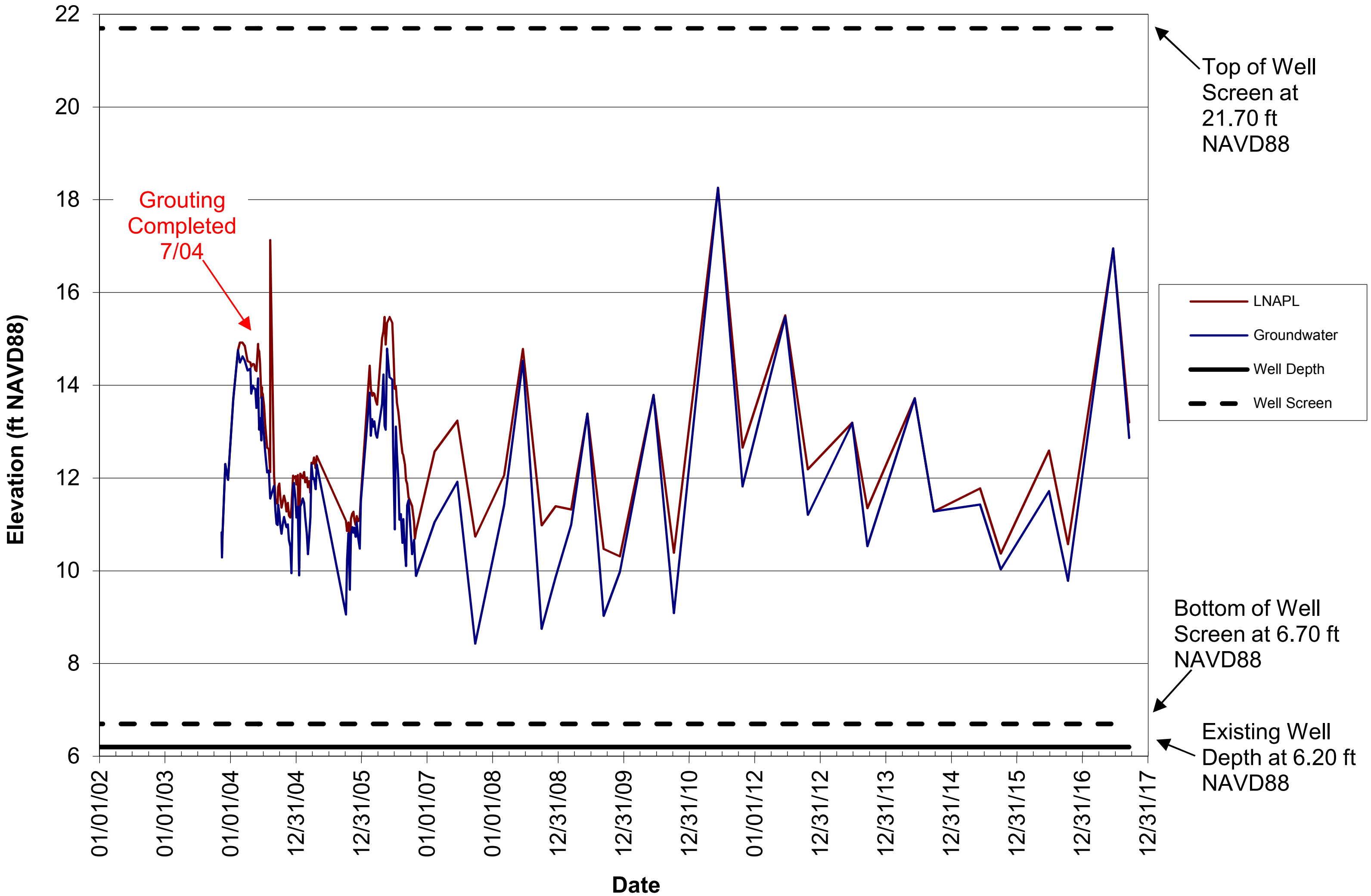
McCormick and Baxter Superfund Site
Portland, Oregon

1999 to 2017 NAPL Thickness Plot for Well EW-23s

11/2017

HARTCROWSER
GSI Water Solutions, Inc.

Figure
4-19

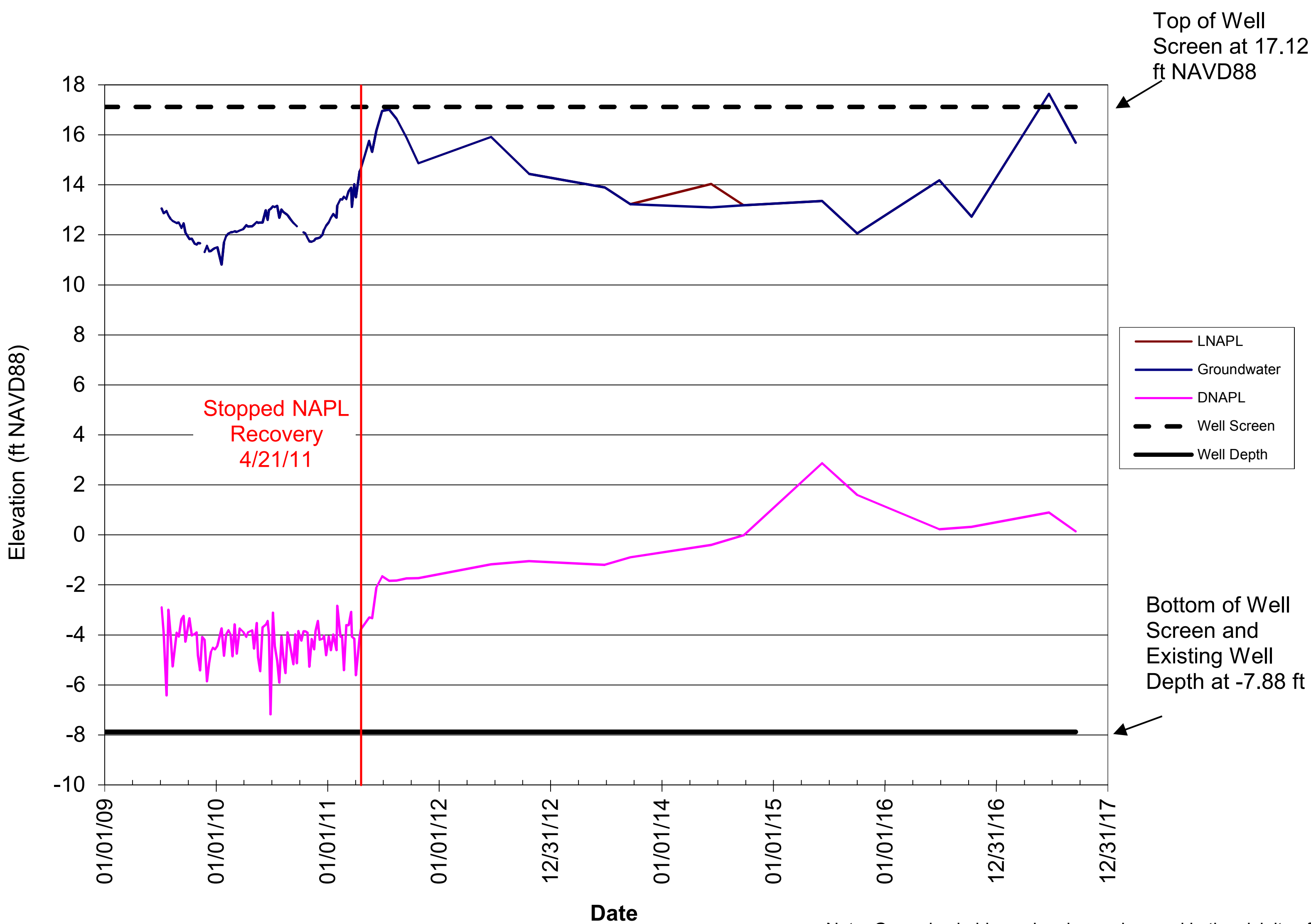


McCormick and Baxter Superfund Site
Portland, Oregon

2003 to 2017 NAPL Thickness Plot for Well MW-56s

11/2017

Figure
4-20



Note: Ground subsidence has been observed in the vicinity of EW-1s and the well casing has sunk over time. The screened interval and total well depth have been referenced to the most recent ground survey from September 2009. Given that the elevations are changing with time, the elevations shown are approximate.

McCormick and Baxter Superfund Site
Portland, Oregon

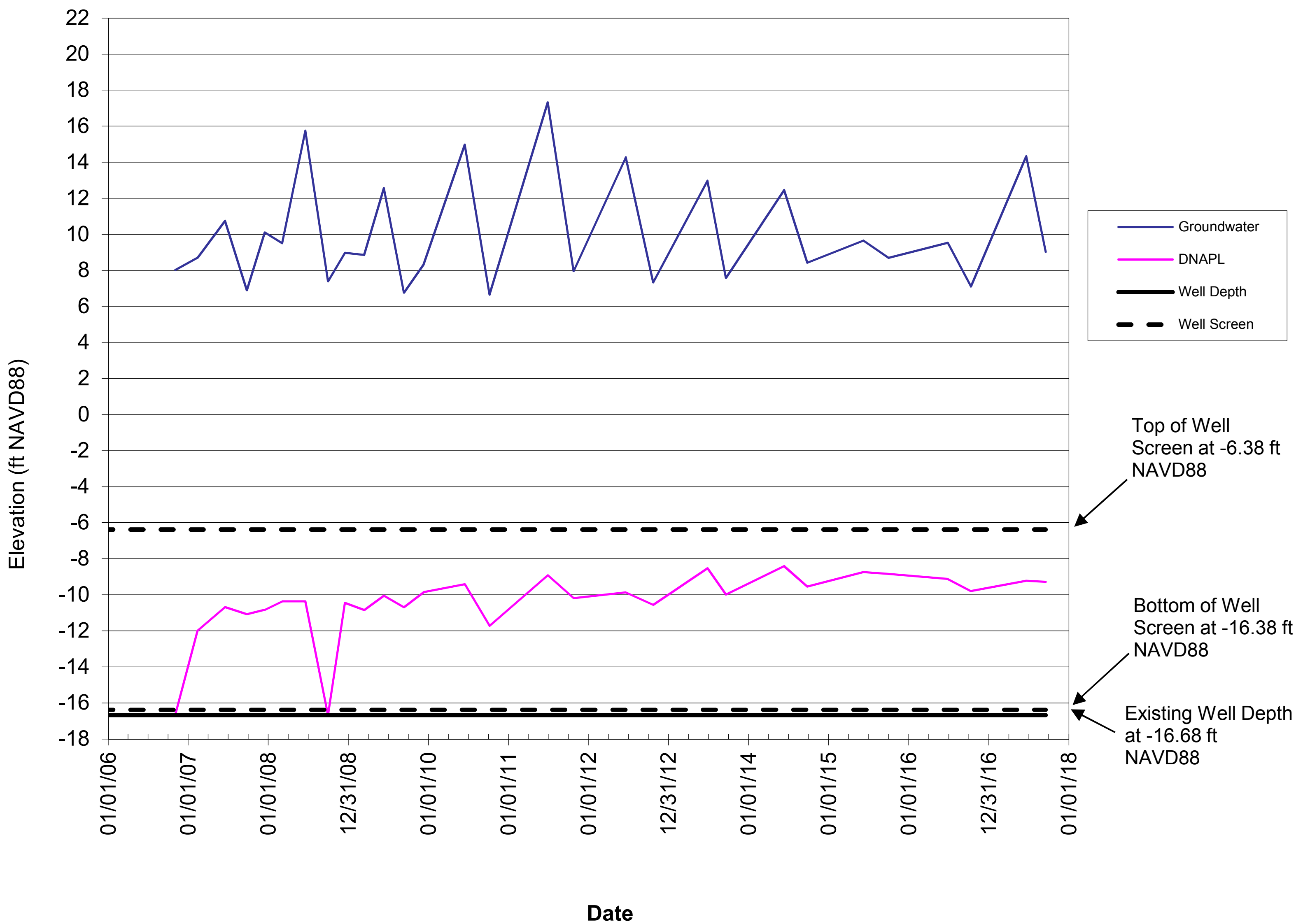
2009 to 2017 NAPL Thickness Plot for Well EW-1s

11/2017

HARTCROWSER

GSI Water Solutions, Inc.

Figure
4-21



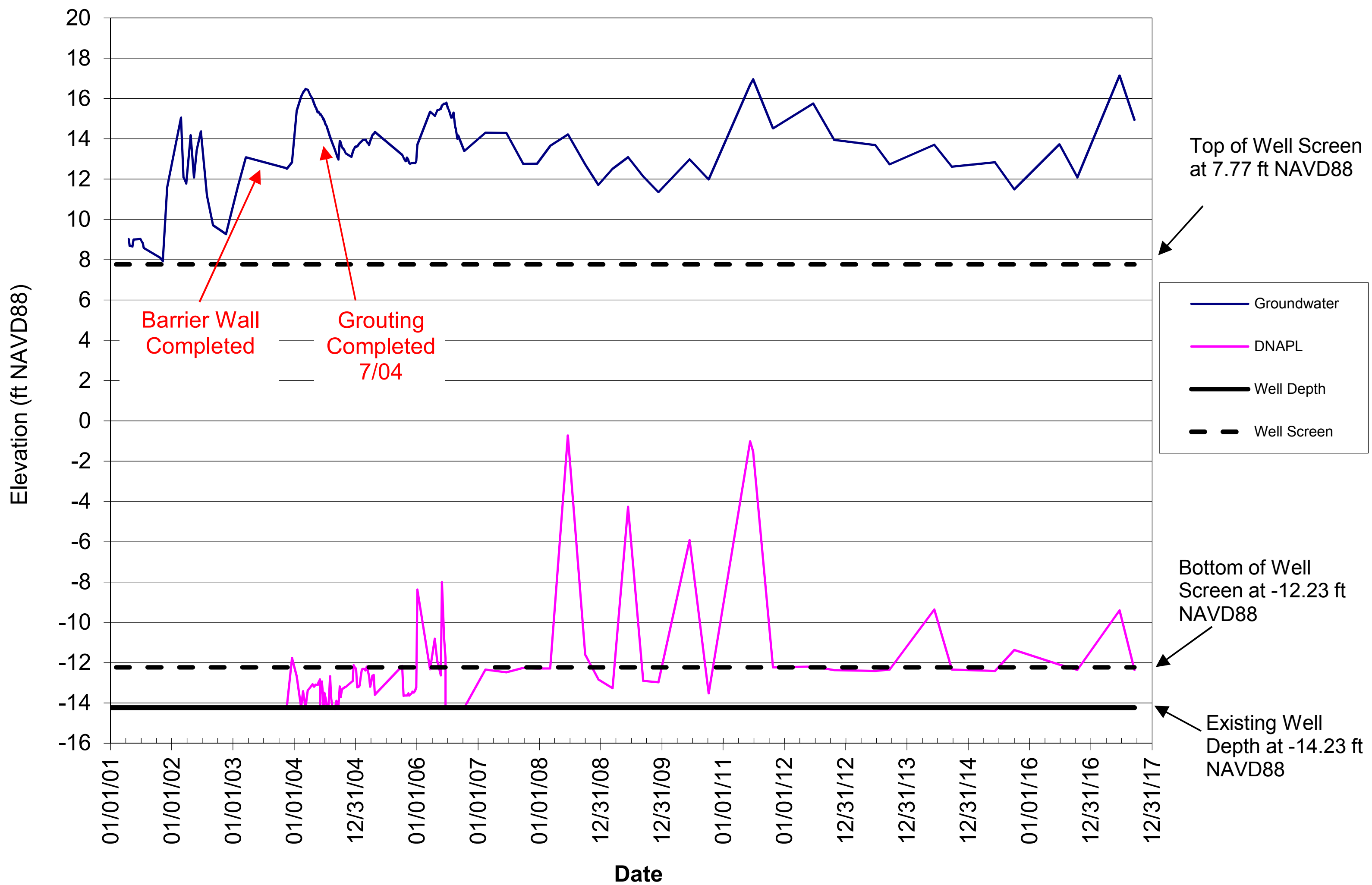
McCormick and Baxter Superfund Site
Portland, Oregon

2006 to 2017 NAPL Thickness Plot for Well MW-22i

11/2017

Figure

4-22



HARTCROWSER

GSI Water Solutions, Inc.

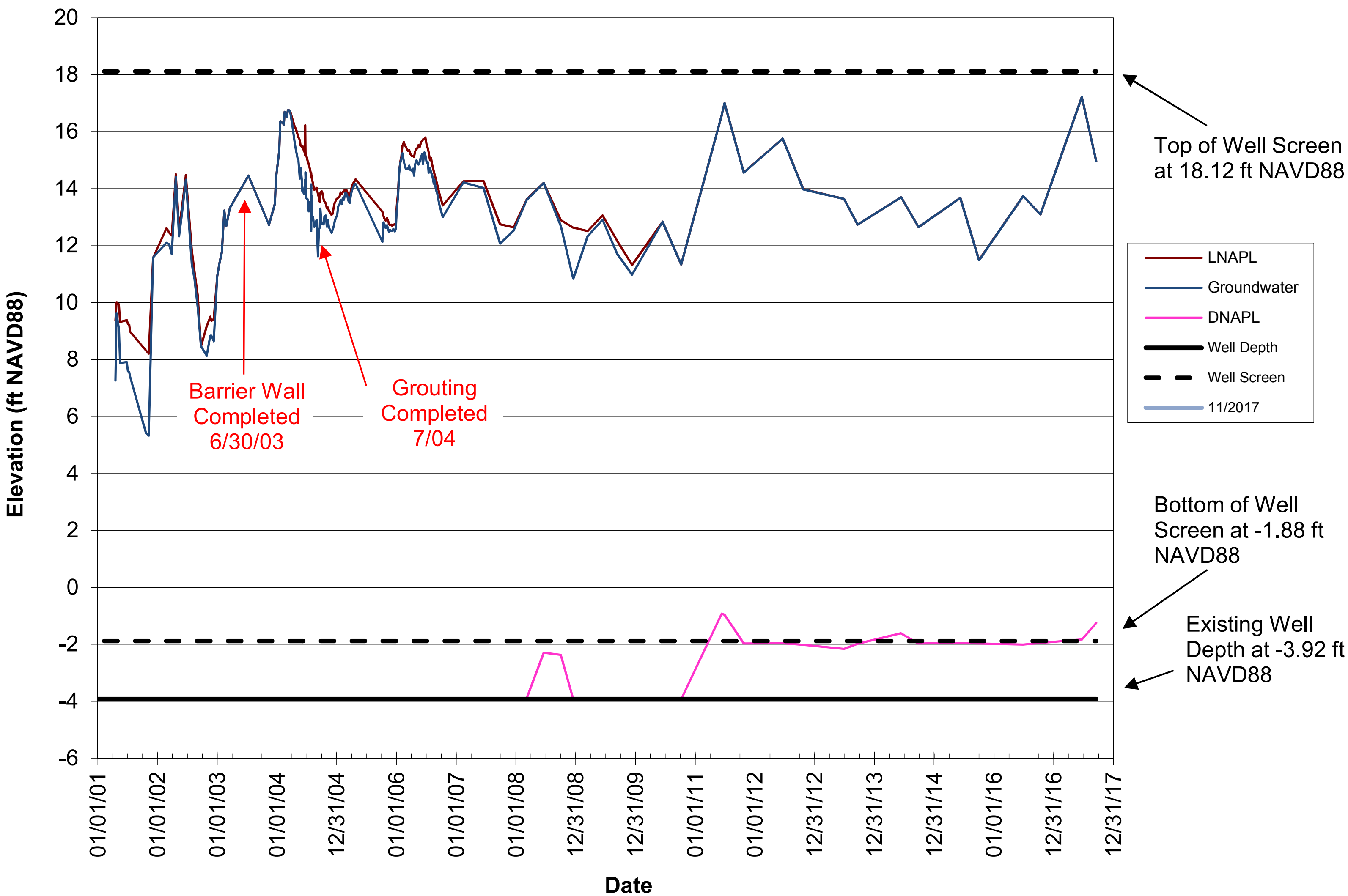
McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2017 NAPL Thickness Plot for Well EW-8s

11/2017

Figure

4-23



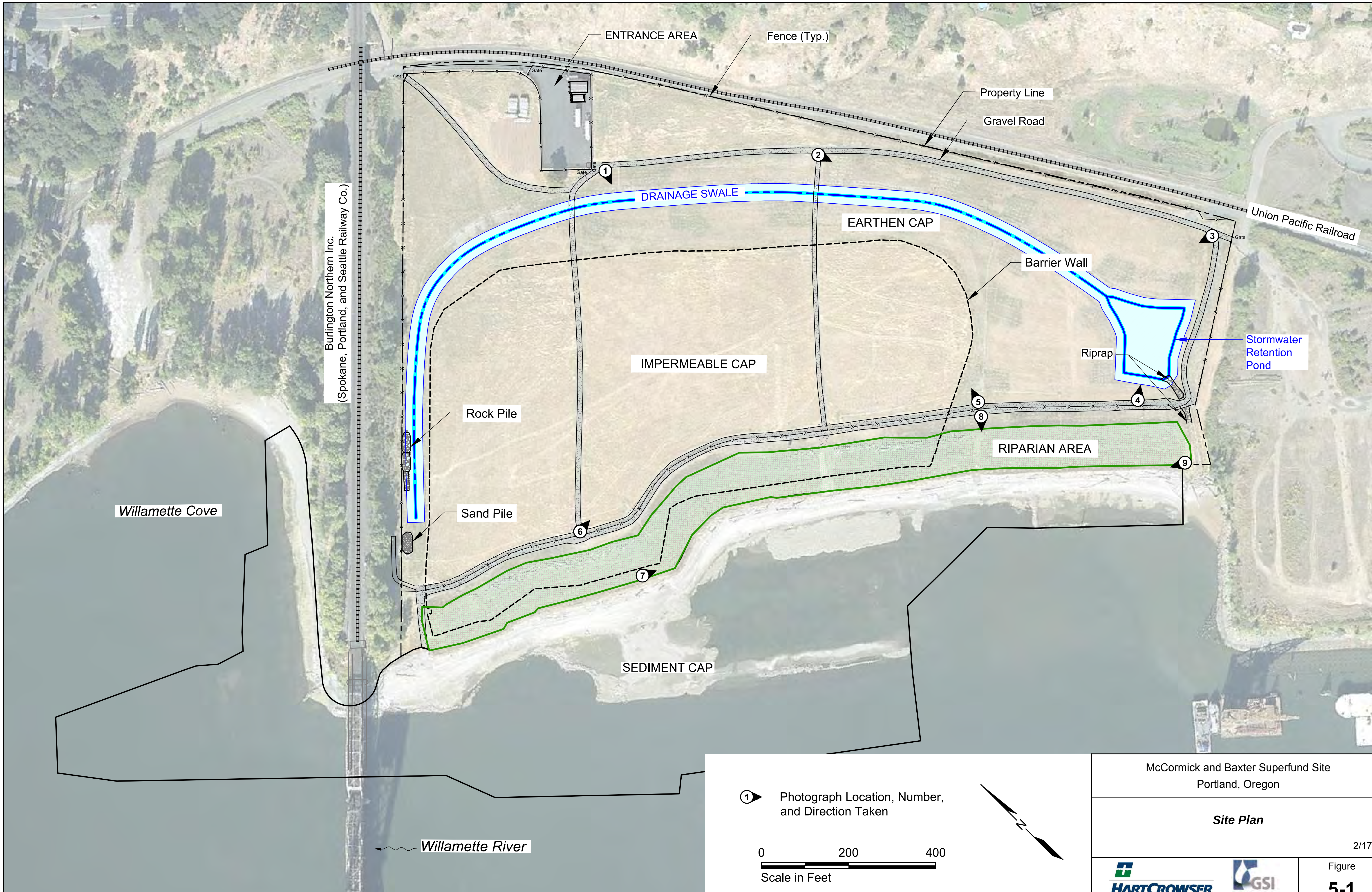
McCormick and Baxter Superfund Site
Portland, Oregon

2001 to 2017 NAPL Thickness Plot for Well EW-18s

11/2017

Figure

4-24



McCormick and Baxter Superfund Site
Portland, Oregon

Site Plan

2/17

HARTCROWSER

GSI Water Solutions, Inc.

Figure
5-1

File: \\Pdxsrv\data\Notebooks\1567010_DEQ McCormick & Baxter O&M\CAD\1567010_(Site Plan).dwg Layout:SitePlan Date: 02-23-2017 Author: melissaschweitzer

APPENDIX A
Photograph Log –
Site Activities and Observations

Photograph 1 – Animal burrow observed during April 2017 site inspection.

Photograph 2 – Trailer removal in February 2017.

Photograph 3 – ACB observed during the July 2017 site inspection.

Photograph 4 – Transient vessel in Willamette Cove – January 2017.

Photograph 5 – Looking north at riparian area on February 23, 2017.

Photograph 6 – Looking east at north section of upland soil.

Photograph 7 – Looking southeast at lupine on central portion of upland soil cap in May 2017.

Photograph 8 – Scotch Broom removal on upland soil cap following spring weed control activities.

Photograph 9 – Gap observed in ACB during April 2017 site inspection.

Photograph 10 – Looking south at the riparian area observed during the fall vegetation inspection.

Photograph 11 – ACB repairs observed during October 2017 site inspection.

Photograph 12 – Detention pond in October 2017.

Photograph 13 – Lower portion of the ACB armoring – May 2017.

Photograph 14 – Highest river level of 2017 observed at the south end of the riparian area on March 30, 2017.

Photograph 15 – Highest river level of 2017 observed at the south end of the riparian area.

APPENDIX B
Site Activity Documentation

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
1/19/17	09:30	AM	10:00	AM	~~[illegible]~~ Phil Cordell	HC	Check Electrical Connection
1/27/17	08:30	AM			Phil Cordell	HC	Site Inspection
1/27/17	830	am			Erin Hughes	GSI	" "
1/27/17	830	am			Sarah Miller	DEQ	" "
4/21/17	1300	PM	1500	PM	Sarah Miller	DEQ	
↓	↓	↓	↓	↓	Phil Cordell	HC	
↓	↓	↓	↓	↓	Erin Hughs	GSI	
5/1/17	0800	am	0845	AM	Phil Cordell	HC	Fire Marshal
						Portland Fire	
5/8/17	0800	AM	1000	AM	Phil Cordell	HC	Veg Control
↓	↓	↓	4:25	PM	luis Amaral Jr	Amaral	↓
↓	↓	↓	↓	↓	Arnoldo hernandez	↓	↓
↓	↓	↓	↓	↓	Antonio estevan	↓	↓
↓	↓	↓	↓	↓	Feliciano estevan	↓	↓
5/9/17	15:30	pm	16:00	pm	Phil Cordell	HC	Veg Control Insp.
5/10/17	9:00	am	9:30	am	Phil Cordell	HC	" "
5/17/17	8:00	am	3:30	Pm	luis Amaral Jr + 1	Amarac nursery	Veg control

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
	930	am	4:30	Pm	luis Amaral Jr	Amaral nursery	~~Stat~~ SPray invasive
5-18-17	6:00	am	2:00	Pm	luis Amaral Sr +1	Amaral nursery	Veg - Control
5-18-17	3:30	pm	5:30	pm	Joriel Amaral	"	"
5-19-17	5:30	am	4:00	Pm	luis Amaral +1	Amaral nursery	Veg - Control
5-23	6:00	am	2:30	Pm	luis Amaral +	Amaral nursery	Veg - control.
5-25	12:00	~~pm~~ PM	14:30	PM	Phil Cordell	HC	veg - control inspt O&M
6-21	8:00am	am	4:30	PM	Phil Cordell	HC	low tide
↓	↓	↓	1:00	PM	Anthony Chavez	HC	↓
↓	↓	↓	1:00	PM	Kaylan Smyth	HC	↓
6/30	1000	am	1:00	pm	Phil Cordell	HC	shoreline & veg inspection
7/20	0900	am	11:00	am	Phil Cordell	HC	July Inspection
↓	↓	↓	10:30	am	Sarah Miller	DEQ	↓
↓	↓	↓	10:30	am	Erin Hughes	GSI	↓
8/1/17	9:45	am	1:30	pm	Phil Cordell	HC	Drought Assessment & O&M
8/8/17					Kaylan	HC	watering
8/18/17	10:00	am	13:30	PM	Phil Cordell	HC	O&M
9/13/17	8:30	am	11:00	PM	Phil Cordell	HC	O&M

Site Visitation Record
McCormick and Baxter Creosoting Company
Portland, Oregon

SITE VISIT LOG

VISITORS AND WORKERS MUST CHECK IN AND OUT

Date	Time IN	a.m./ p.m.?	Time OUT	a.m./ p.m.?	Name	Name of Company, Agency, or Organization	Comment (Purpose of Visit, etc.)
9/19/17	0800	am	13:00	pm	Anthony Chavez	HC	low-tide monitoring
↓	0800	am	13:00	pm	Kaylan Smyth	↓	↓
	0800	am	16:30	pm	Phil Cordell		
9/20	10:00	am	15:20	pm	Phil Cordell		cap repairs
9/20	10:00	am	15:20	pm	Kaylan Smyth		↓
9/21	8:15	am	17:00	pm	Phil Cordell		
9/21	8:15	am	17:00	pm	Kaylan Smyth		
10/23/17	830	am	12:00	pm	Phil Cordell	HC	Site inspection
↓	↓	↓	10:30	am	Erin Carol Hughes	GSI	↓
			10:30	am	Sarah Miller	DEQ	
11/17/17	10:00	[illegible]	15:00	pm	Phil Cordell	HC	O&M

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 1/27/2017
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Friday, January 27, 2017. The next inspection is scheduled for April 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper; however, vegetation was observed to be growing in the ACB voids.

The Willamette River at the time of inspection (between 8:30 PM and 10:30 PM) was between 5.14 and 4.69 feet COP (or 10.14 – 9.69 NAVD88). Low tide was at approximately 12:45 PM with a tide of approximately 4.26 feet COP (or 9.36 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10-15 gallons per minute. The outfall is in good condition, but moss is covering much of it.

Ten derelict boats anchored within Willamette Cove were observed during the site walk. The river level was relatively high, but the upper sections of ACB in Willamette Cove was exposed and relatively clean and free of debris; however, a large amount of drift wood has been deposited along the Willamette River shoreline.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and in Willamette Cove during the inspection.

Wildlife spotted along the shoreline included Canada geese.

In December 2015, shoreline repairs were completed in certain areas where soil had eroded from beneath the turf-reinforced matting (TRM) above the ACB. The repairs involved pulling up the TRM, placing new soil, and planting shrubs in areas where erosion was observed. The repairs look good, but much of the vegetation planted along the top of the bank has perished; however, native grasses, shrubs, and weeds have started growing and the area appears to have stabilized (no erosion evident).

A lot of garbage and debris has been deposited along the shoreline due to high river levels. The amount of debris will be assessed during the spring inspection, after river levels have receded, and a determination made on whether a beach trash removal event is warranted.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that is frequently observed at the site.

Stormwater drainage at approximately 15 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is consistent with recent measurements.

Various small birds and scat were spotted in the upland portion of the cap. Lots of animal burrows were observed around the site and coyotes have been recently spotted.

The job trailer leaks were repaired during the winter of 2015, but birds have made new holes in the trailer and are living in the walls. The trailers are scheduled to be removed February 9, 2017.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Draft Annual Report	Phil Cordell/Erin Hughes	February 2017
■ Coordinated trailer/surplus equipment removal and organize trailer/shop.	Sarah Miller/Phil Cordell	February 2017
■ Vegetation Management Firm Procurement for spring spraying	Phil Cordell	February/March 2017

Site Activities / Miscellaneous Field Activities

- The last two replacement transducers were installed in December 2016 and water levels from the existing transducers was downloaded.

Deliverables

No deliverables were submitted since the last site inspection.

Action Item:	Person Responsible:	Deadline:
Hart Crowser and GSI will prepare the 2016 Annual Report.	Phil Cordell/Erin Hughes	February 2017
The DEQ may prepare a memorandum detailing the potential impacts the Portland Harbor ROD has on the M&B ROD.	DEQ w/ assistance from HC/GSI	TBD

Budget Status: November 2016 through January 2017 were at/or below the anticipated budget. A BAP covering costs associated with the trailer removal was submitted to the DEQ in December 2016 and a task order amendment was issued on January 19, 2017.

Meeting Status:

Date / Time	TBD – January - April 2017	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 4/21/2017
1:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Friday, April 21, 2017. The next inspection is scheduled for July 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) was scoured from many areas of the upper ACB and deposited further down the bank. High river levels and tidal fluctuations were likely responsible for the gravel erosion. Some gravel within the ACB voids has been removed in scattered areas, especially along the seams between the ACB mats, leaving 2-4 wide inch voids where the geotextile fabric underlayment is exposed (see attached picture). Gravel was still observed in most of the upper- and mid-bank portion of the ACB armoring; however, the areas where the ACB gravel has been eroded present a tripping hazard.

Areas of TRM were also disturbed by the high-water levels. River levels appear to have crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood that caused damage to the TRM in scattered areas. The high water resulted in the TRM separating from ACB in a few areas, the TRM tearing in at least one area, and swaths of topsoil being eroded from above the TRM along portions of the upper bank.

The Willamette River at the time of inspection (between 1:00 PM and 2:30 PM) was between 10.66 and 10.84 feet COP (or 15.66– 15.84 NAVD88). Low tide was at approximately 11:00 AM with a tide of approximately 10.48 feet COP (or 10.59 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 30-40% of the rock armoring below the outfall was washed away from the drainage channel.

Three derelict boats anchored within Willamette Cove were observed during the site walk. The river level was high, so the ACB in Willamette Cove was not exposed.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline. The area above the granular organoclay in Willamette Cove could not be observed during the inspection.

Wildlife spotted along the shoreline included Canada geese and a red tailed hawk near the contractor area.

Much of the soil and plantings placed during the shoreline repairs in December 2015 were washed away by high river levels.

A lot of garbage and debris has been deposited along the shoreline due to high river levels. A trash removal event is warranted because the accumulated trash is likely to remain in place through the summer.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that is observed at the site.

Stormwater drainage at approximately 10 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Animal burrows were frequently observed around the site.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	May 2017
■ Low-tide monitoring	Phil Cordell	June 2017
■ Coordinate shoreline repairs	Phil Cordell/Sarah Miller	Spring/Summer 2017

Site Activities / Miscellaneous Field Activities

- Transducer data will be downloaded during the June 2017 low-tide monitoring event.

Deliverables		
Final 2016 Annual Report - April 6, 2017.		
Action Item:	**Person Responsible:**	**Deadline:**
No deliverables scheduled for 2nd quarter 2017.		

Budget Status: January 2017 through April 2017 were at/or below the anticipated budget. We will begin preparing a new BAP for O&M activities from June 2017 through December 2017 in May.

Meeting Status:		
Date / Time	TBD – July 2017	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 7/20/2017
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on July 20, 2017. The next inspection is scheduled for October 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) was scoured from many areas of the upper ACB and deposited further down the bank. High river levels and tidal fluctuations were likely responsible for the gravel erosion. Some gravel within the ACB voids has been removed in scattered areas, especially along the seams between the ACB mats, leaving 2-4 wide inch voids where the geotextile fabric underlayment is exposed (see attached picture). Gravel was still observed in most of the upper- and mid-bank portion of the ACB armoring; however, the areas where the ACB gravel has been eroded present a tripping hazard. Repairs to the ACB voids are planned for September 2017.

Areas of TRM were also disturbed by the spring high-water levels. River levels appear to have crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. The high water resulted in the TRM separating from ACB in a few areas, the TRM tearing in at least one area, and areas of topsoil being eroded from above the TRM along portions of the upper bank. Sedimentation and deposited debris appear to be securing loose TRM in most places. This will continue to be monitored and additional repairs may be needed if further damage occurs during the 2017/2018 winter.

The Willamette River at the time of inspection (between 8:30 AM and 10:00 AM) was between 4.4 and 4.6 feet COP (or 9.4 – 9.6 NAVD88). Low tide was at approximately 1:00 PM with a tide of approximately 3.0 feet COP (or 8.0 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at <0.5 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 30-40% of the rock armoring below the outfall was washed away from the drainage channel.

Four derelict boats anchored within Willamette Cove were observed during the site walk. The river level was high, so the ACB in Willamette Cove was exposed and appeared to be in good condition.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

Wildlife spotted along the shoreline included a snake on the ACB, ducks in the river, and various small birds in the riparian area.

Most of the garbage and debris observed on the shoreline during the spring inspection has been removed and a relatively small amount was visible.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that frequents the site.

Stormwater drainage at approximately <1 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Animal burrows were frequently observed around the site.

Action Items:	**Person Responsible**	**Deadline**
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	Fall monitoring
■ Low-tide monitoring	Phil Cordell	September 2017
■ Coordinate shoreline repairs	Phil Cordell/Sarah Miller	August/September 2017

Site Activities / Miscellaneous Field Activities

- Transducer data will be downloaded during the September 2017 low-tide monitoring event.

Deliverables		
None.		
Action Item:	**Person Responsible:**	**Deadline:**
No deliverables scheduled for 3rd quarter 2017.		

Budget Status: April 2017 through July 2017 were at/or below the anticipated budget. We will begin preparing a new BAP for O&F activities from September 2017 through January 2018 in August.

Meeting Status:		
Date / Time	TBD – October 2017	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 10/23/2017
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on October 23, 2017. The next inspection is scheduled for January 2018.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

September 2017 shoreline ACB repairs appear to be in good condition and will be monitored throughout the winter.

Areas of TRM were also disturbed by the spring high-water levels. River levels appear to have crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. The high water resulted in the TRM separating from ACB in a few areas, the TRM tearing in at least one area, and areas of topsoil being eroded from above the TRM along portions of the upper bank. Sedimentation and deposited debris appear to be securing loose TRM in most places. This will continue to be monitored and additional repairs may be needed if further damage occurs during the 2017/2018 winter.

The Willamette River at the time of inspection (between 8:30 AM and 10:00 AM) was between 3.0 and 3.2 feet COP (or 8.0 – 8.2 NAVD88). Low tide was at approximately 1:00 PM with a tide of approximately 2.2 feet COP (or 7.2 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10-15 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 30-40% of the rock armoring below the outfall was washed away from the drainage channel.

Four derelict boats anchored within Willamette Cove were observed during the site walk. The river level was high, so the ACB in Willamette Cove was exposed and appeared to be in good condition.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

Garbage and debris was removed by Hart Crowser following the September shoreline repairs.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that frequents the site.

Stormwater drainage at approximately 15 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Animal burrows were frequently observed around the site.

The warning sign located in the SE corner of the site has fallen down and needs to be repaired.

Action Items:	Person Responsible	Deadline
Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
Vegetation Management	Phil Cordell	Fall monitoring
Low-tide monitoring	Phil Cordell	September 2017
Coordinate shoreline repairs	Phil Cordell/Sarah Miller	August/September 2017
Repair perimeter sign	Phil Cordell	Winter 2017
Annual Report	Phil Cordell	December 2017/January 2018

Site Activities / Miscellaneous Field Activities

- Transducer batteries were replaced in October 2017 following the site inspection.

Deliverables

None.

Action Item:	Person Responsible:	Deadline:
Annual Report	Phil Cordell	December 2017/January 2018

Budget Status: July 2017 through October 2017 we are at/or below the anticipated budget. New budget requests will be prepared in December 2017.

Meeting Status:

Date / Time	TBD – January 2018	
Location	McCormick & Baxter Facility	Site Office

APPENDIX C
Photograph Log – Vegetation Observations

Photograph 1 – Earthen cap and drainage swale in the foreground with the impermeable cap in the background. Taken looking south from Photograph Station 1 comparing baseline and current conditions. (Left - June 2011; Right - June 2017)

Photograph 2 - Tree and shrub plantings on the earthen cap. Taken looking southeast from Photograph Location 2. (June 2017)

Photograph 3 – Eastern edge of the earthen cap looking toward the drainage swale. Taken looking west from Photograph Location 3. (June 2017)

Photograph 4 – View of stormwater pond. Willow and alder have increased in size, although most of the pond remains barren or vegetated with grasses. The irrigation system was removed in 2016. Taken looking northeast from Photograph Location 4 comparing baseline and current conditions. (Left - June 2011, Right - June 2017)

Photograph 5 – Tree plantings on the earthen cap. Taken looking north from Photograph Location 5. (June 2017).

Photograph 6 – Impermeable cap dominated by grasses and herbaceous vegetation. Baseline photograph on the left taken looking east from Photograph Location 6 (June – 2011). Current conditions from June 2017 shown on the right.

Photograph 7 – Vegetation growth and wood debris within the lower riparian component and along the shoreline. Taken looking southeast from Photograph Location 7 comparing baseline and current conditions. (Left - September 2011, Right – June 2017)

Photograph 8 – Upper riparian component with native trees and shrubs performing well. Taken looking southwest from Photograph Location 8. (June 2017)

Photograph 9 – Lower riparian component with large wood debris along the edge. Taken looking northwest from Photograph Location 9 comparing baseline and current conditions. (Left - June 2011, Right – May 2017)

Photograph 10 – South end of the lower riparian area, looking northeast. Oregon ash, red osier-dogwood, and oak trees are faring relatively well within this area. (October 2017)

Photograph 11 – Middle portion of upper riparian area, looking south. A Grand Fir exhibiting drought and/or disease stress. (October 2017)